Coping and Caring:

Institutions, Transition, and Families under Economic Pressure

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I Introduction

"If the misery of the poor
be caused not by the laws of nature,
but by our institutions,
great is our sin."
Charles Darwin
Voyage of the Beagle[1]

The misery of the poor and, more generally speaking, inequalities in standards of living are fundamental issues, not only for natural scientists like Charles Darwin but also economic history and historical demography. The 'long nineteenth century' (1789-1914) truly transformed the world (Osterhammel 2014)[2] in this and many other respects. With industrialisation, the level of wealth, comfort, material goods and necessities available began to diverge strongly between certain geographic areas and social classes. So strongly that the entire Western world has become completely resilient to crises of the pre-industrial type, while some regions in east Africa still suffer almost regularly from hunger.[3] When looking at the early 19th century, a clear divergence in GDP per capita emerges between Western Europe and the remaining parts of the world. This has not only accelerated with time but has continued up to today.

Scholars have developed a considerable number of theories to explain this early take-off of the West, this 'Great Divergence' (Pomeranz 2000). The availability of coal, market structures and state interventions (ibid), innovation (Clark and Feenstra 2003; Landes 2006), colonialism as both a de-industrialising force in colonised countries and a land provider for Europe in the New World (Bairoch 1976; Pomeranz 2000), luxury consumption, property rights (Pomeranz 2000; Rosenberg and Birdzell, JR. 1999; Lin 1995), culture (Weber 2005 [1904]; Weber et al. 2008; Rosenberg and Birdzell, JR. 1999), political fragmentation (Mokyr 2017) and `good and bad´ political behaviour

[1] Darwin et al. 1989 [1817].
[2] Orig. in German: Osterhammel 2009.
[3] Africa as defined under the United Nations geoscheme.

and institutions (Acemoglu and Robinson 2012) are sound examples. And while all of these play their part in explaining the Great Divergence, the one theory that might be considered the most traditional (and perhaps therefore the most influential) remains that of rising (or not collapsing) real wages and living standards. This theory was put forth by Thomas Robert Malthus at the turn of the 19th century (1798-1830, Malthus and Gilbert 2004[4]). Further developed by Robert Allen (Allen 2001), it essentially states that high wages support health, consumer demand, and other aspects of life (cf. Allen 2001, p. 435), and that rising real wages would also stimulate human labour-supplementing technologies and therefore technological advancement (Allen 2011). Beginning with Malthus' essays (Malthus and Gilbert 2004) on population growth's relation to living standards, scholars follow the grand theory that there must be something special about the 'Western Countries' and their demographic systems which explains the lion's share of their early economic success. In Malthus´ view, this special demographic feature of the West is an endogenous population check of fertility, deliberately performed by the couples in question, that prevents population growth outpacing food production. In turn, hyperbolically formulated as in Richard Whitings provocative song "Ain't We Got Fun?", the rich West gets richer while the poor 'others' get – children (Whiting 1921).

Over the last two or so decades, global or grand theories and universal explanations of economic history and historical demography, such as Everett Lee's theory of migration (Lee 1966), John Hajnal's explanation of marriage patterns (Hajnal 1965) and the grand narratives of fertility decline in Europe (Notestein 1945) have come under renewed review and critique. With today's computational methods and the fact that more data is now available than the above-mentioned scholars could ever have dreamed of, yet more counterexamples can be given that do not fit into the frameworks offered. Processes of differentiation of the grand theories mentioned become inevitable. The same has happened to Malthus' grand theory of population growth and the 'uniqueness' of the demographic system of the West, especially that of England. In "*Life under Pressure: Mortality and Living Standards in Europe and Asia 1700-1900*" (Bengtsson et al. 2004) and in two consecutive volumes (Tsuya et al. 2010; Kurosu and Lundh 2014), researchers from the Eurasia Project on Population and Family History (EAP) gathered new individual demographic data to scrutinise the Malthusian paradigm from a micro perspective. Through analysing household

[4] There are several editions and versions published between 1798 and 1830, with updates, supplements, and minor changes.

responsiveness to short term economic shocks, they were able to model the vulnerability of households to daily crises in order to compare the demographic check behaviour of western European and east Asian societies. Their findings were groundbreaking for historical demography, as they clarified that there is no western Europe and 'the rest of the world': instead, largely determined by institutions, vulnerability to economic stress indeed "differed considerably" between Europe and Asia (Lee et al. 2004a, p. 17), but clearly not in the simplistic way suggested by a dichotomous world view in the tradition of Malthus. Malthus had contrasted an East governed by a "positive check" of mortality to a West governed by a "preventive check" of fertility. However, the EAP researchers showed that the positive check was as strong in the West as in the East, and that a preventive check existed in both areas. Furthermore, the positive check of population, previously thought to only operate exogenously, actually appeared to be a matter of decision making. When analysed further, mortality responses to economic pressure were selected and controlled by the respective populations of all the countries researched, "[i]n the West with a socio-economic gradient, in the East with a household gradient" (Bengtsson 2016, p. 170). Malthus was also mistaken about fertility control in Asia. Instead of being absent, the preventive check in China and Japan was just different in organisation and execution when compared to Europe: in Europe, it was almost exclusively pre-natal through delayed marriage, life-time celibacy (especially in women), birth spacing and later birth stopping (Lee et al. 2010, pp. 323f). For Asia, there was also pre-natal birth control, such as through male celibacy or stretching birth intervals. In addition to this, (female) infanticide (post-natal birth regulation) was commonly applied to limit the overall size of the household or family (ibid.), leading again to rather high male celibacy in later life (Lee and Wang 2001, pp. 71, 105). Instead of being absent, the preventive check in 19th century east Asia might be even more powerful in regulating population growth than in Europe.

From their results, the EAP researchers concluded that parents' control over their children's family formation is crucial to understanding the modi operandi of the checks. In east Asia patriarchy, the socio-political power of fathers and family patriarchs and hierarchy inside the household were the decisive features for manifesting parental control, and to consequently shape the character of Chinese and Japanese population checks (Lundh and Kurosu 2014, p. 10). According to Wolf, the Christian church in Europe, with its final say on the sacred act of marriage, created a far less pronounced patriarchy (Wolf 2005, p. 231). This weaker patriarchy in turn allowed for the very limited control of parents over their children and their decisions. The main (if not only) instrument

for parents to exercise power over their children was through control of their property (ibid.). Inheritance strategies thus seem to influence demographic responses in Europe decisively (Lee et al. 2004a, p. 19). Whether or not as a result of this, the main actors involved in marriages were different. While marriage was exercised on a more individual level in Europe, and thus by the (future) couple itself, decision making and timing in China was determined on a collective level (Lee and Wang 2001, p. 9).

1.1 Research Question

The results of this large and outstanding project have clarified that institutions and human behaviour, not simple geography, are decisive in shaping population behaviour at both extremes of Eurasia. Both formal institutions (written public rules and laws) and informal institutions (specific cultural customs inherent to and applied by a society) play a key role in individual and couple demographic decision making under economic pressure. As indicated by the EAP researchers themselves, formal and informal institutions differ greatly across the distances covered by their project (over 8000km from London to Beijing). The heterogeneity in operating population checks described above therefore comes as little surprise. By definition, much 'noise', too many other factors are left when explaining the heterogeneity in check-responsiveness to economic stress. For instance, Fertig's dismantling of older beliefs in the widely accepted niche-principle (Medick 1977; Fertig 2003b, 2005), where couples can only marry if a farm is free to be taken over by them, indicates that the inheritance practices mentioned above might be insufficient for decisively shaping demographical behaviour for most layers of society. Instead, according to Fertig, capital accumulation possibilities play a much bigger role in reducing constraints for marriage (Fertig 2003b, 2013). How important are property rights and inheritance laws and practices for easing marriage constraints in economically bad years? And for whom? Are institutions that promote capital accumulation (such as savings banks or liberal labour markets) and cash flow smoothening institutions (such as pawn shops and small scale creditors) not more relevant to explaining differences in individual and couple demographic decision making? Do growing relief and the emerging social state finally bring about resilience to crises of the pre-industrial type? Or are all these institutions part of an individual or a family 'mixing of various

strategies' (Kok 2002, p. vii) to deal with economic resource constraints, further explaining the Great Divergence?

A valid comparison of the impact of institutions on demographic behaviour with case studies in these very different settings of the EAP thus appears rather difficult, automatically leaving the methodology of the EAP somewhat disproportionate in this respect. A more detailed study is needed instead, one which minimises the 'noise' and keeps important exogenous variables (such as geography, climate, disease, environment, religion) constant. In other words, and following Marc Bloch's call to contrast similar societies rather than very distant ones (Bloch 1964), the EAP methodology should be embedded in a local, comparable geographical and cultural context. Only in this way it will be possible to detect the institutions that are essential to shaping couple demographic behaviour and their vulnerability to economic pressure. In order to do exactly this, this study will investigate demographic response-heterogeneity to economic pressure in a very limited geographical setting. Such a setting is provided by the northwestern European border triangle of Belgium, The Netherlands, and Germany (map 1):

Map 1: The Border Triangle Belgium, The Netherlands, and Germany

The map shows that even though there are three state borders that promise the desired institutional heterogeneity needed for this study, the geographical surface of this field site is small. Indeed, an imaginary triangle from Maastricht to Liege to Aachen would account for a surface of less than 500km², about 2/3 of the city of Berlin. This small surface diminishes differences in geography,

climate, disease, environment, religion etc. (the 'noise') dramatically when compared to the EAP. Therefore, within the border triangle of Belgium, The Netherlands, and Germany (from now on mainly referred to as just the Border Triangle for simplicity), I intend to analyse three case studies: the communes of Würselen (Germany), Meerssen (The Netherlands), and Sart (Belgium), and to ask:

Which institutions trigger the emergence of heterogeneity in individuals´ and couples´ demographic decision making under economic pressure at the dawn of the industrial revolution? How does the interplay of these attenuating counter institutions shape their responsiveness to economic stress?

This research question contains the assumption that demographic decision making under economic pressure was, to a large extent, similarly structured before the onset of the industrial revolution in the region under research in the following sense: under economic stress, couples would postpone increases in the family's consumption through pre-natal birth regulation (delaying marriage and/or child birth) until their economic situation improved. Of course, differences in demographic decision making are expected to be found within the communes (e.g. among richer and poorer strata) but much less so between them, as long as they all are trapped in a Malthusian world. Only with industrialisation and institutional changes will larger and observable differences become visible. The analysis will elaborate upon whether this assumption can be upheld. The research question also implicitly states that a clear relation between economically worsening conditions, bad harvests and the delaying of marriage is apparent and statistically provable, and that, with the advent of new formal institutions, this relationship would disappear with time through the course of the period studied, the 19th century: couples living in a commune with access to a savings bank that allows for small scale savings accounts and regular interest, for instance, must be expected to have an advantage in smoothing bad economic years towards couples without such opportunities. The former must thus be expected to be less vulnerable to economic stress. This expectation would be similar for couples that benefit from institutions such as inheritance laws and practices, capital accumulation and lending possibilities, poor relief and modern social laws, or the labour market structure.

Of course, the logic of demographic behaviour is not only determined by formal institutions. Informal institutions, cultural practices and historically developed customs (such as family structures and ties, voluntary work from elites, religious teaching and beliefs) have the potential to influence a couple's demographic decision making. These informal institutions, however, are the most difficult ones to reconstruct and to measure. In this study, inspired by the socio-legal approach of the Colonialism Inside Out project,[5] the analyses will mainly focus on formal institutions. The Colonialism Inside Out project is an interdisciplinary one, in which researchers analyse the everyday interactions between an Asian society (Sri Lanka) and growing European bureaucracy. It focuses on how normal people react to and live with newly introduced formal institutions (such as taxation, legal action and religion) that were set up by the Dutch East India Company (VOC). That the present study will 'mainly' focus on formal institutions may also mean that some informal institutions (such as family structures and ties) will be embedded in the analyses if they add up to a better reconstruction and/or modelling of couple decision making. With this approach, the everyday life of all the members of a society under industrialisation and modernising state bureaucracy can be analysed in a scientific way.

"Coping and Caring: Institutions, Transition, and Families under Economic Pressure" further allows for the addition of evidence to related sub-questions, which are either answered unsatisfactorily or are still regularly debated in the literature. For example, there is a new, controversial strand of research that questions the classical assumption that larger families are better providers of protection for their members in times of economic hardship when compared to nuclear ones (Laslett 1988; de Moor and van Zanden 2010; Bouman et al. 2012). It will also be of interest to test which family organisation type is more vulnerable to economic stress and why. Related to this is the question of family ties, and whether caring and strong families are better at coping (Alesina and Giuliano 2007; Fertig 2009; Kok and Mandemakers 2010). Little is known also about the institutions that actually generate differences in demographic decision making. One question which would be applicable here concerns whether inheritance practices and any related property transmission are decisive for smoothening economic crises and, if so, to what extent and for whom (Bengtsson et al. 2004; Bengtsson and Dribe 2002a; Fertig and Fertig 2006), or if the

[5] http://www.ru.nl/historicaldemography/research-projects/current-research-projects/virtual-folder/colonialism-inside-out/.

modernising state's institutions, and which ones, penetrate and shape couple demographic decision making under pressure, to what extent and to whom.

1.2 Adding Evidence

Studying a very limited geographical area is indeed not new. Research on the micro level usually follows an approach in which several communes (inside a specific smaller or larger region which belongs to one specific state) come under scrutiny and are compared to one another (Wrigley and Schofield 1989; Guinnane and Ogilvie 2008; Edvinsson and Broström 2012). Depending on the research design, the respective regions and the results of intra-regional comparison might also be contrasted with other such regions (Bengtsson et al. 2004; Tsuya et al. 2010; Kurosu and Lundh 2014). A study of the Border Triangle brings a new perspective to existing research: this cross-border-region offers manifold geographical small scale institutional heterogeneity in a comparable environment, in Bloch's sense. It constitutes an environment that invites the study of institutional differences at different levels of organisation, shaped by the regulations of the authorities in the commune (local), the province (provincial), or the state (national).

For Germany (Würselen) and the Netherlands (Meerssen), the region provides non-researched genealogical data suitable for event history analyses. This data is stored in a single data base, the Familienbuch Euregio, and therefore guarantees an identical structure derived from very similar sources in kind and quality. A comparison of these two communes also allows for the reduction of the usual intra-source comparison-noise towards null, promising to reveal robust results. The data for the Belgian part of the Border Triangle (Sart) proposed for analysis here has been the subject of intense research in this and related respects (Alter et al. 2001; Neven 2002; Alter et al. 2004a, 2004b; Alter et al. 2004c; Alter and Oris 2008; Alter et al. 2010; Oris et al. 2014). New, unpublished archive data will be added to more thoroughly reconstruct Sart's historical context and its economic stress attenuating institutions with respect to the research question of this study.

In terms of the number of publications concerning the present and related topics in historical demography with Belgium and the Netherlands, Germany clearly lags behind. Though there are major works by specialists such as Sabean, Schlumbohm, Medick, and Fertig (Sabean 1990; Schlumbohm 1997; Medick 1997; Fertig 2007) and more recent studies in the field (Guinnane and Ogilvie 2008; Guinnane and Ogilvie 2014; Fertig and Fertig 2017; Willführ 2009; Voland and

Willführ 2017; Dribe and Scalone 2010), individual event history analyses are still the exception for Germany. Every study on Germany thus strengthens the field of historical demography in the country and allows for it to catch up with the leaders in the field.

Finally, the results may reveal insights about how strongly either (national) formal public institutions and thus political power or specific (local) informal institutions and cultural and societal customs are more decisive in overcoming the Malthusian regime. Though this probably a nice-to-have-result, its relevance should not be underestimated in a European Union trying so desperately to find a balance between regional, national, and European administrative power.

Such micro-level research also comes with strong advantages to aggregate research: the results promise to be more precise in terms of variables that might influence demographic behaviour, such as social diversities, sex, social-strata, age, etc. However, micro studies always face problems with a lack of representation. Only by adding more such micro-level studies to the existing research can we widen our coverage and confirm these findings (Bengtsson 2016, p. 171). With this study, three more micro-level case studies for the communes of Würselen (Ger), Meerssen (NL), and Sart (Be) will be added to the existing research, helping to do exactly that.

1.3 Setup, Aims, and Limits of This Study

The study is to be read from a New Institutional Economics perspective, meaning that when explaining demographic behaviour as a consequence of economic phenomena, a strong focus will be given to legal norms and social rules or customs, to formal and informal institutions[6]. Acemoglu and Robinson also have this perspective and claim that efforts to explain economic change without taking institutions into consideration are insufficient (Acemoglu and Robinson 2012, pp. 45–69). With the three cases to be studied, the set up is of a comparative-explanatory style. Comparison is necessary for establishing 'social facts' in the sense of Emil Durkheim (Durkheim 2010[1895]) or 'historical facts' in the sense of Marc Bloch (Bloch 1964), and to find similarities or differences between them.

The main problem tackled in this study, namely what leads to demographic differentiation in response to economic pressure, makes it necessary to go back to the pre-industrial period, at the

[6] For a detailed discussion on New Institutional Economics, see Rutherford 2001, pp. 185–190.

beginning of the 19th century. Here, it will be possible to observe institutional and behavioural change. Where possible, the research will cover the French period in the Border Triangle (from 1794 to 1914), which in turn marks the last year of the 19th century for the historian.

To be able to answer the questions above, hypotheses about the influence of institutions on a demographic system's reaction to economic pressure can be derived from the existing literature and tested. The study will tackle the testing of these hypotheses with a mixture of a qualitative and quantitative study arrangements: the analysis will begin with the qualitative reconstruction of the rather broad historical context in which the Border Triangle has been embedded in throughout the 19th century. This reconstruction will cover the most important political, economic and social topics. The reconstruction of local socio-economic history and the institutional context[7] for each of the communes under research will then be considered. In doing so, prevailing institutions related to overcoming economic stress will be elaborated upon and analysed according to the analytical framework. The main idea of the hypotheses testing section, the quantitative part, is to set economic stress, the formerly elaborated institutions, and couple demographic responses into relation with the help of statistical modelling methods, hereby focusing on the 'preventive check'. With this approach, I propose a method that treats institutions as instruments for improving couples´ resilience to economic pressure and that tries to measure the impact of each individual institution. One goal of this study is to develop a method that allows for the quantitative measuring of institutional impact on demographic behaviour. It does not aim to perfectly measure every possible impact of every possible instrument as, of course, no holistic perspective could be taken in this way. However, within a reasonable and theoretically founded framework, this method can be tested and a first step be made in a direction that might be further developed by future scholars. Previous research has shown that marriage and fertility are susceptible to economic stress (EAP; Galloway 1988; Lee 1990). With marriage generally being both the precondition for fertility in the 19th century and the main 'tool' for the 'preventive check' (Szreter and Garrett 2000, p. 52), the statistical analyses for all three communes will concentrate on this life event as the primary indicator for deliberately planned demographic behaviour.

In order to detect and illustrate demographic behaviour on an individual level, state of the art event history analyses will be applied. The data used in this study is composed of archive work and a

[7] A set-up which has also been suggested by Sokoll 2001.

classical literature review, which will be carried out to reconstruct the historical local realities of the three communes and to reproduce both formal and informal institutions for the course of the 19th century. As the focus lies on counter institutions to exogenous economic stress caused by economic crisis, it is reasonable to leave aside endogenously caused economic stress resulting from family misfortune, such as the death of the income provider.[8] Instead, like the classical works of Malthus, this study will focus on economic pressure arising from short-term economic crises caused by bad harvests. Time series of grain prices will be taken as proxies or, where not revealing enough evidence, further economic stress indicating proxies developed. The demographic data for Germany (Würselen) and the Netherlands (Meerssen) is provided by the Familienbuch Euregio, an extensive genealogical database[9] containing information of about 500,000 individuals.[10] This data so far remained unexplored in the sense of the present study, and comes with a strong focus on both the 19th century and the Border Triangle itself. The data for Belgium (Sart) is provided by The Population Registers of Sart 1811-1900.[11] This data will be re-examined through the magnifying glass of new archive data and in comparison to the two remaining field sites. Overall, this approach guarantees an analysis carried out in a consistent manner and also promises statistically significant results.

The examination of individual and couple diverging abilities to cope with economic stress within the historical and institutional context of the area under research will reveal new insights into the emergence of institutionalised economic inequalities. Through a comparison of three neighbouring communes separated by state borders, the role of both the state (on different levels) and the community in shaping institutions relevant to overcoming economic stress will be evaluated. The study therefore follows a bottom-up comparative approach of two dimensions, an intra-regional one inside the Border Triangle and, through embedding the results into the existing literature, one of general comparison. Following the trend of former studies in the field, it can generally be expected that more counter examples of Malthus' grand theory will be found in this dissertation. It will add further "particularistic explanations" to "middle-ranged" theories (Merton 1968; Szoltysek 2007, p. 31) on the relation between demographic systems and living standards, rather

[8] For further reading on this topic, see Derosas and Oris 2002.
[9] For a critical discussion of genealogical data, see Section 3.4.
[10] http://www.familienbuch-euregio.de/euromap.html, birth entries taken as an approximation.
[11] http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/32461.

than supporting the Malthusian grand dichotomous narrative of a ‘preventive system’ and a `positive´ one. Instead, the purpose of this dissertation is to reveal new insights into living standards in the past and the emergence of perpetuated institutionalised vulnerability through studying the changing abilities of individuals and couples to cope with economic stress.
With historical studies, however, a problem that often occurs is the unequal distribution of source material. One example of an unequal distribution of source material in this study is the information given on migration for specific individuals or families at a specific point in time. While this information is available for the Belgian part of the Border Triangle thanks to extensive research, it is not available for Würselen or Meerssen. In such or similar cases of unequal distribution of source material, the reader will be made aware of the problem and the study work with proxies.

Together with this introduction, the study will be divided into six chapters. In the following chapter, the reader will be introduced to the main concepts used, obtain an overview of the current state of the research, and follow the development of the analytical framework under which this study will be carried out. From this literature review, the development of relevant testing hypotheses will help to answer the overall research question. The third part will be dedicated to explaining the methodology, and then to examining and discussing the data used in this study. In part four, the reconstruction of the historical settings of the sites under research will be carried out, with respect to the prevailing institutions relevant for overcoming economic stress. The fifth part, the statistical analysis, will begin with a descriptive statistics section that informs the reader of the main demographic features of the three communes. Then the results of the calculations will be presented and critically assessed, first for each commune separately and then in comparison to one another. The results will then be added to the bigger picture and integrated into the current research discussion. The sixth and final part will close with a summary, the answering of the overall research question, and a discussion of the possible flaws and shortcomings of the study, opening up a path for future researchers.

II Theoretical Background

This chapter will provide definitions of the key terms and concepts used in the study, an overview of the current state of research, the development of the hypotheses that will help to answer the overall research question, and an analytical framework.

2.1 Terms and Concepts

2.1.1 Institutions

To avoid possible misunderstandings, definitions for institutions and organisations must be identified. According to North, institutions are the "rules of the game", the constituting framework in which humans pursue their course of action, while organisations are "the players", the agents inside that frame (North 1992). From a New Institutional Economics perspective, "[t]he constraints imposed by the institutional framework (together with the other standard constraints of economics) define the opportunity set and therefore the kind of organizations that will come into existence" (North 1992, pp. 9f). This means that, in order to understand changes or differences in agency in general and, more specifically, the agencies of individuals and couples, one must understand the framework provided by the institutions in place.

Hodgson states that "[i]nstitutions are the kinds of structures that matter most in the social realm: they make up the stuff of social life" (Hodgson 2006, p. 2). In other words, institutions can be loosely defined as the formal and informal rules and norms that organise social, political, and economic relations. These "rules of the game", however, are not permanent. Instead, institutions change over time. Some, such as tax laws, change more easily than, for example, social behaviour. For the timeframe they work in, however, they establish a predictable structure for human interaction (North 1990, pp. 3, 6; Giddens 1984).

Institutions shape but do not always determine behaviour (Leftwich and Sen 2010, p. 9). This shaping of behaviour may lead to both negative and positive impacts on life in a society, depending on the degree of the institutions' extractive or inclusive character – the degree to which these institutions either exploit or benefit most members of society (Acemoglu and Robinson 2012, chapter 3). A society's economic success or failure are conditioned by the allocation of available

resources in that society (Leftwich and Sen 2010). Not only are institutions indispensable for understanding economic phenomena and change, but they are also their main explanatory tool.

For a more detailed definition that allows us to distinguish between 1) formal and 2) informal institutions and to critically assess their respective impact on the decision making of individuals and couples, institutions must be further subdivided and classified into two categories. The first of these is formal institutions, which are usually enforced by the (state's) authorities. In a legal sense, formal institutions are dedicated to a certain type of use, typically used for educational or charitable purposes, or for the dispensation of law (OVG Münster 1976; Kirkpatrick et al. 1983). This dispensation of law (administrative power) may be executed either strictly or weakly by third parties. A concrete example which is relevant for this study is the institution of inheritance laws and inheritance practices: the actual inheritance *laws* in force for the Border Triangle are very similar throughout the 19th century. However, the degree of de facto execution and enforcement of them most probably differs strongly in these borderlands, where much older inheritance *customs* will at least have an influence on actual practice. It is likely that regions where families are more patriarchally organised stick closer to the given law than others (Todd 12/7/2007).

2) The second category is informal institutions, which may also differ across borders. Turner describes informal institutions (social authorities, as he labels them) as "a complex of positions, roles, norms and values lodged in particular types of social structures and organising relatively stable patterns of human activity with respect to fundamental problems in producing life-sustaining resources, in reproducing individuals, and in sustaining viable societal structures within a given environment" (Turner 1997, p. 6). Institutions are thus not always initiated by administrative authorities. Instead, 'social authorities', or customs that are much than older laws and more deeply rooted inside a society, culture, and associated ideology (Leftwich and Sen 2010, p. 16) determine, to a large extent, social behaviour – sometimes more than laws themselves. Inheritance practices can indeed be expected to be such a case.

From this distinction, it becomes clear that both types of institutions contain economic stress-attenuating functions: a lowering of taxes by the state authorities during shock years will clearly reduce the pressure of a family, while a passed-on habit of saving money for bad times may do the same, or better.

The concept of institutions presented here inevitably leads to the question of their distribution within a society and that distribution's corresponding economic effects on society: in other words,

that distribution's effects on living standards. The next concept to be defined is therefore living standards.

2.1.2 Living Standards

Today, a concept of living standards would usually encompass the "degree of wealth and material comfort available to a person or community" (Stevenson 2011). In this form, it is usually applied to compare social conditions between countries or regions, or between societies at different points in time. Together with the broader and more complex concepts of quality of life and well-being, which, when following the common OECD "How's Life" measurements[12], include qualitative variables such as housing conditions, work-life balance, education, health status, emotional well-being, environment quality, personal security (OECD: Organisation for Economic Co-operation and Development 2017), every researcher faces the challenge of finding a clear, acceptable and practicable definition for their purposes. It will also be necessary to identify and determine suitable and realistic measurements in order to make comparison possible. The most holistic quality of life analysis was carried out by the researchers involved in the "How Was Life" project (van Zanden et al. 2014). This project aimed to rebuild the OECD's report as closely as possible, all the way back until 1820.[13] The researchers measured and analysed most of the variables used by the OECD through direct measurements or proxies. However, the bulk of the data for such measurements was only available for larger geographical entities, such as continents, countries, or regions. For the micro study to be pursued here, and using the resources available, such a holistic approach would not be operational.

The most important problems concerning definitions, conceptual frameworks, and measurements of living standards when it comes to comparative research over time and space for micro studies are tackled by Allen, Bengtsson, and Dribe (Allen et al. 2005, pp. 1–22). In their attempt to challenge the established view of Asian 'backwardness' in terms of living standards in the 19th century, the authors devote a whole chapter to the conceptualisation and measurements of living standards in the past that appear to be suitable for this study. That chapter shall therefore serve as a guide for defining living standards and conceptualising their measurement: the authors first

[12] "How's Life" is a biennial report on the world's well-being, published by the OECD.
[13] For a list of covered, non-covered, and approximated indicators, see van Zanden et al. 2014 p. 27ff.

define an ideal concept of living standards by describing it as "the total utility a person derives from consuming a set of goods as a result of labour, investment, or transfers" (Allen et al. 2005, p. 6). However, such a definition is still not operational, as the utility of goods usually depends on their characteristics. As the authors themselves claim, we cannot measure this. Therefore, "most concepts of standard of living focus on goods themselves, or the ability to access them" (ibid.). This is something which we can indeed measure, though a focus alone is not enough for defining an entire concept. Instead, a practical definition is needed that provides the reader with the exact idea of what is understood by living standards for the remainder of this study. I therefore propose the following practicable yet very precise definition: living standards will refer to *the level of wealth, material goods and necessities available to a certain group in a certain geographic area*[14]. If a pre-industrial society is able to provide all the basic necessities for its members, even under unfavourable economic circumstances (such as in a short term crisis caused by a bad harvest), it can be said to have high living standards. If not, the opposite is true (Bengtsson and Dribe 2002a, p. 9). Once a certain threshold is surpassed, living standards will be high enough to make the society no longer vulnerable to short-term economic stress. The mechanism of a society dealing with short term crises will be further elaborated upon in the Analytical Framework section, with the technical measurement of short term economic pressure being described in the Methodology chapter.

The next sub-chapter gives an overview of the current state of research in the field. From here, hypotheses will be developed. The theoretical framework will then be presented, under which this study will be carried out. Together with the definitions developed above, it will be possible to identify the institutions relevant for the study.

[14] http://www.investopedia.com/terms/s/standard-of-living.asp#ixzz1VUli2yEI, adapted.

2.2 Literature Review

It is safe to say that Thomas Robert Malthus remains the most influential figure in historical demography. The Malthusian paradigm has been most influential, and is still the starting point (though almost never the endpoint) of many studies in the field (e.g. EAP, Galor 2011; Lucas 2017; Wrigley 2004; Broadberry et al. 2015). For most researchers, a link between a country's living standards and its demographic system has been thought necessary ever since the publication of Malthus' "Essay on the Principle of Population [...]" in 1798 (Malthus 1798). The relevance of his work for this study cannot be overestimated: under Malthus' main assumptions (first that "food is necessary to the existence of man" and second that "the passion between the sexes is necessary and will remain nearly in its present state" (Malthus, chapter II)), population, when unchecked, grows exponentially while food production does so 'only' linearly. The problem here is that a gap opens up between the means of subsistence and the number of people that have to be nourished by these means, a gap which widens further over time. Eventually, according to Malthus' observations, "[t]his difficulty must fall somewhere and must necessarily be severely felt by a large portion of mankind" (ibid.). The result of these developments is the so called 'Malthusian Trap', which describes a population constantly living on the margin of subsistence while being subjected to recurring positive population checks (with "positive" evidently referring to "inevitable", not "favourable" or "good"). In Malthus' view, a positive check operates exogenously, meaning that it is uncontrolled and non-selective. It limits population growth through human disasters such as diseases, famine, epidemics and war, closing the gap by pushing the population back to a level at which it can sustain itself with the resources available. In societies subjected to this type of demographic regime, living standards cannot improve, as resource surpluses are immediately consumed by the (then) growing population.

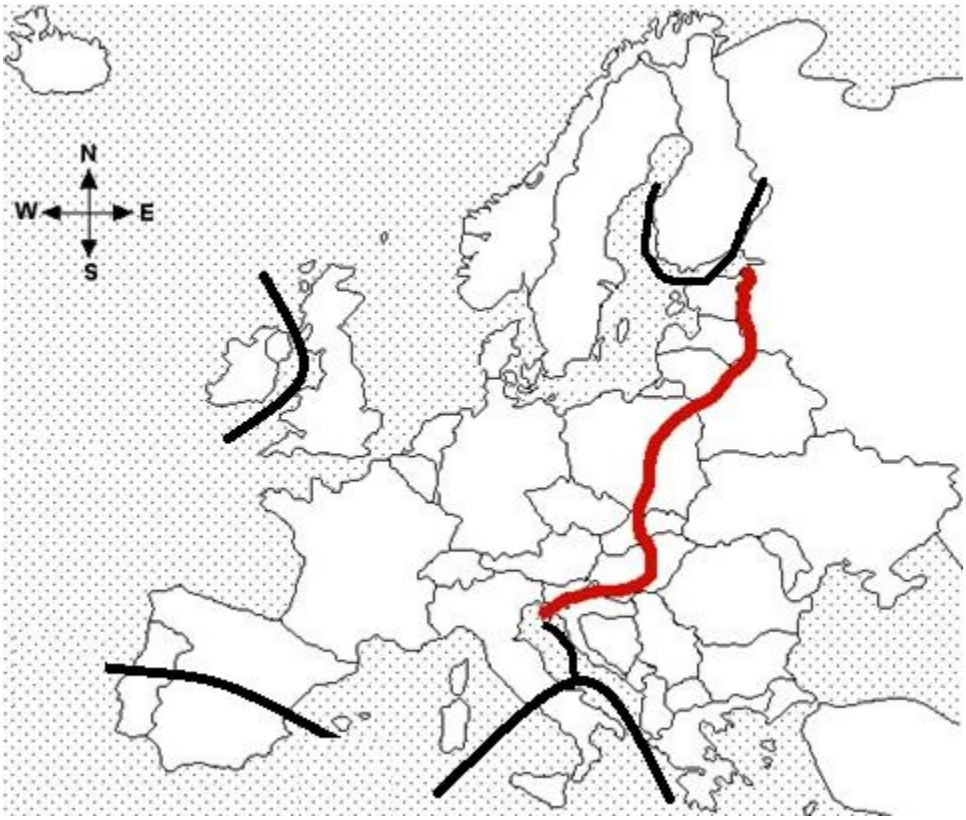
A preventive check would be a counter strategy to the Malthusian Trap: other than the positive check, a preventive check operates endogenously, thus controlled by the respective population. It is therefore by definition selective. According to Malthus and his followers, it was present in northwestern Europe, especially in the England of his time. Individuals would deliberately limit their overall birth-rates in order not to stretch the family's resources too far. Following Knodel´s study on the onset of fertility transition in rural Germany, "[t]he average completed fertility of a group of married women can be expressed as a simple function of their starting, spacing, and

stopping behavior" (Knodel 1987, p. 153). In other words, delaying marriages, stretching birth intervals, and the decision not to have another child determined the overall size of the family. Amongst these options, delaying marriage was *the* "primary means to regulate reproduction in early modern Britain" (Szreter and Garrett 2000, p. 52). A population under such a preventive demographic regime would grow more slowly than (rather than parallel to) food production, and would thus be able to provide higher living standards for the whole population. Savings would be fostered and capital accumulation made possible (Jones 1981, pp. 15ff; Voigtländer and Voth 2006, pp. 347f; Foreman-Peck 2011), which in turn would help to keep the entire economy stable and economic growth more constant. The demographic regime of the Border Triangle, lying in northwestern Europe, must be expected to be such a preventively checked one.

Malthus' ideas were also followed by the Cambridge Group for the History of Population and Social Structure (founded in 1964). After several years of research with new quantitative methods, pioneers Peter Laslett and Tony Wrigley, amongst others, further strengthened the Malthusian Paradigm. In their now-classical works, such as "Household and Family in Past Times" (Laslett and Wall 1972) and "The Population History of England 1541-1871" (Wrigley and Schofield 1989), the overall conclusion is that late marriage and the preventive check were already a reality in England during the 18th century. These results fostered new interest in the interplay of economics and demographics. With this, the interest in the research of household structures, intrinsically tied to marriage, stratification and social mobility, gained new momentum.

With marriage behaviour apparently so important for studies concerning the interplay of economics and (historical) demography, marriage behaviour itself deserves a closer look: in 1965, John Hajnal developed his idea of a European Marriage Pattern (Hajnal 1965). From this followed the division of Europe's marriage patterns into late-marrying Western Europe and early-marrying Eastern Europe.

Map 2: The Hajnal Line



Source: Hugh 2008, adapted.

West of the red line stretching from Saint Petersburg to Trieste, excepting black pockets to the northwest, northeast and south, Hajnal defines the following key aspects of the "European Marriage Pattern" (EMP):

- average age for first marriage: 24 years for women, 26 for men
- a relatively small age difference between the partners
- a relatively large percentage of people who never married: around 10% - 20%

The Eastern European Marriage Pattern[15], east of the red line, ideally looks as follows:

- average age for first marriage: around 22 for women, unspecific for men
- age differences larger between partners (usually larger than two years)

[15] The term "Eastern European Marriage Pattern" would be developed later by Czap (Czap 1982).

- almost everyone will eventually marry

A couple of years later, in rather similar fashion, drawing on Laslett's and Wall's elaborations on Household and Family in Past Time (Laslett and Wall 1972) and others, Hajnal (Hajnal 1982) extends his concept of a uniquely Western marriage pattern onto households, establishing some formation rules. According to him, formation rules common to northwestern European simple household systems are:

- late marriage for both sexes (Hajnal implicitly sets the EMP as a prerequisite)
- after marriage, a couple are in charge of their household (the husband is head of the household)
- before marriage, young people often circulate between households as servants
- A small number of other relatives within the household (added from later inference)
  (Hajnal 1982, pp. 455f)

Formation rules common to joint household systems (and thus, according to Hajnal, more eastern patterns) are the following:

- earlier marriage for women and particularly for men (mean ages at first marriage is under 21 for women and under 26 for men)
- a young married couple often starts life together in a household where an older couple still lives and remains in charge, or in a household where an unmarried older person (such as a widower or widow) continues to be the head. Usually, the young wife joins the husband's household
- households with several married couples may split to form two or more households, each containing one or more couples
- larger number of other relatives, where almost everyone is a relative of the household's head (added from later inference)
  (Hajnal 1982, p. 452)

The roots of such an east-west divide are found in the works of Malthus or maybe even earlier

(Thornton 2001, 2005). But with Hajnal´s framework, despite justifiable critiques and much variation that can be expected within this framework as claimed by Hajnal himself, this western perspective has become rather normative in most of the available literature. With Peter Laslett's "Family Life and Illicit Love in Earlier Generations" further setting England (Laslett 1977b) and Western Europe as 'the standard' (Szoltysek 2007, p. 14) and Eastern Europe and the rest of the world as dichotomously diverging from it, the benchmarks were set and the paradigm cemented for the next decades.

However, this universal dichotomy of a West with late marriages, small households, and preventive population checks and an East as its simple counterpart must now be seen as having been refuted. By adding an "Eastern European perspective" and drawing on studies of Eastern European colleagues (e.g. Sklar 1974; Chojnacka 1976; Todorova 1983), Szoltysek dismantles the grand narrative of the east-west dichotomy. He concludes that "[a]lthough partly impressionistic, the findings of Eastern Europeanists discussed above revealed enough diversity of family forms and in the rhythms of their development in historical eastern Europe to free us finally from a simplistic view of the continent's familial history, and particularly the perspective implied by the notion of a 'dividing line'" (Szoltysek 2012, p. 38). Going further east, Dennison (Dennison 2003) and Matuzak and Borovik (Matuzak and Borovik 2017) make clear that in Russia, there is no such thing as a uniform eastern society of early universal marriages and large joint households. Most importantly, the results of the three volumes of the EAP have brought about such a large number of examples that a binary east-west taxonomy no longer holds.

The classics mentioned provide theoretical aspects that gave (and continue to give) stimuli for future research: readers of Hajnal, for instance, would read the so called "niche" argument in his work of 1965. This argument can be understood as "an 'elaborate' interpretation of Hajnal´s European Marriage Pattern" (Fertig 2005, p. 4). It essentially states that the social norms in Western Europe allowed couples to marry only if they were able to provide for their own. They would have to wait until a neo-local *niche* became available to be taken by that couple, mostly through the death of parents or inheriting their land. For peasant societies, this created an 'iron chain of reproduction and inheritance' (Medick 1976, p. 303; Imhof 1976, p. 206; Alter 1991, p. 1). Here, population would be checked naturally by late marriage and high celibacy rates, as couples either had to wait a long time to inherit property from their parents, remain in lifelong celibacy when excluded from inheritance or were forced to migrate, lowering the pressure on the

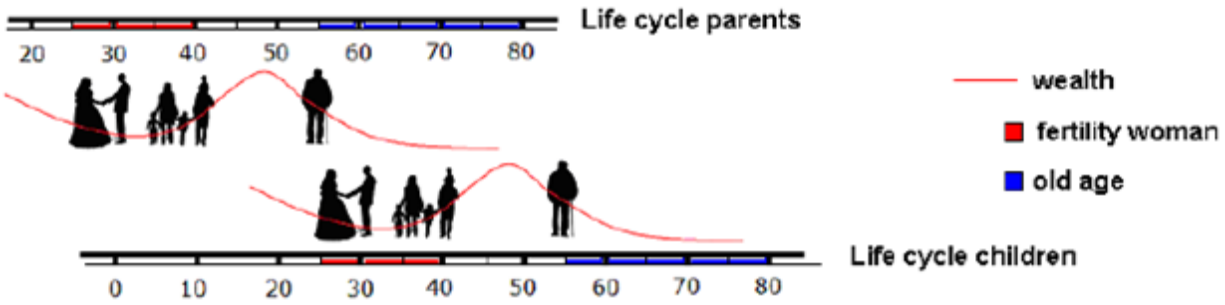
population that stayed. Therefore, many either married late or couldn't marry at all (in the absence of such a niche). As a consequence, positive checks could be avoided, capital accumulation made possible, and the wealth of the society, on the whole, grew.

This interpretation, though important, can today be regarded as insufficient for explaining the EMP (Fertig 2003a, pp. 80f; Fertig 2003b, p. 110). When assuming that day-labourers, landless weavers or spinners, farriers etc. established households too, it becomes obvious that an explanation for marriage patterns through (land-) inheritance practices alone cannot suffice. Inheritance was probably less important than functioning credit and land markets for marrying when taking into consideration that the Western European neo-local household formation (see again Hajnal´s classification, Hajnal 1982) through marriage was expensive. Marriage called for sufficient funds, and when taking into account that bank credit was not available for young couples without monteary or real estate reserves, late marriage in Western Europe can also be explained by the *need* to accumulate savings through labour in advance. This need, as some scholars claim, could only be encountered because of the in Western European institution of life-cycle servant-hood and female labour market participation (Wall et al. 1983; de Moor and van Zanden 2010). In their paper on "Girl power", de Moor and van Zanden (2010) trace back the roots of servanthood to the late Middle Ages, showing it to be much more common in Northwestern Europe than in Southern Europe, explaining a large share of Northwestern Europe's early economic success. The authors argue that a combination of life cycle servanthood, the high share of female servants, and the higher female participation in the labour market (when compared to Southern and Eastern Europe) led to a delay in marriage. Together, the need to build up such a fund, life-cycle servanthood, and female labour market participation produced "a high age at marriage, non-universal marriage, and most importantly, a marriage behaviour that was elastic to the fluctuations of the economy" (Fertig 2005, p. 6). This Western prudence made savings easier and "not only supported a higher standard of living", as suggested by Malthus, "but also promoted savings, the accumulation of capital, and the habits of thrift and foresight required for [the] transition" to modern economic growth (Tsuya et al. 2010, p. 24, drawing on Hajnal 1982; MacFarlane 1978, 1987).

Turning to households and what follows on from marriage, according to Reher, the EMP, together with the neo-local marriage and a specific cultural understanding of the family (Reher 1998, p. 214), with rather weak family ties, leads couples towards the establishment of a nuclear household, independent of their parents. In his paper on the "[…] consideration of the `nuclear

hardship´ hypothesis" (Laslett 1988), Laslett finds a connection between the nuclear family system and the existence of support from the collective in times of economic pressure. According to Laslett, neo-local marriage constitutes the basis of this nuclear family system/nuclear household and "[t]he nuclear-hardship hypothesis would imply that the prevalence of neo-local marriage rules and other nuclear family norms had something to do with the indispensability of transfers through the collectivity" (Laslett 1988, p. 165); in other words, the EMP, together with the neo-local marriage and a specific cultural understanding of the family with rather weak family ties, fostered formal economic stress-attenuating institutions, such as public poor relief and retirement funds. The specific life cycle of nuclear families at some points in time squeezed their resources so dramatically (e.g., during a period when many children were still young or the couple already very old) that support from the collective was needed. A large share of the population "was liable to poverty at some points in their lives but solvent most of the time") (Laslett 1988, p. 166). Bouman, Zuijderduijn, and de Moor illustrate these thoughts through a scheme:

Figure 1: Life Cycle of a Family inside the EMP-Area

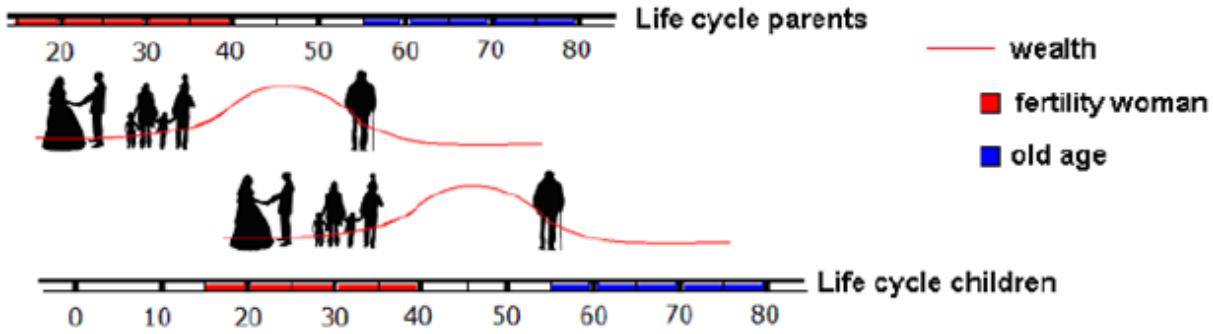


Source: Bouman et al. 2012, p. 10

Figure 1 shows the life cycle of a family inside the EMP area: the marriage age determines, to a large extent, whether "some points" of squeezed resources, roughly between 30 – 40 and 60-70 years of age, coincide for parents and children. Late marriage and child births over more generations made it more likely that both parents and children needed support at the same time: the former because they were too old to sustain themselves, the latter because they had to take care of new-born children (and potentially their parents).

A marriage age of more than one generation would shift the resource squeezing points and lower the risk of both parents and children being in need of support at the same time. In this case, the side not under pressure could help the other when in need (see Figure 2).

Figure 2: Life Cycle of a Family outside the EMP-area



Source: ibid.

According to Bouman, Zuijderduijn and de Moor, another high-pressure feature of the EMP is a small age gap between partners, leaving both vulnerable to age at the same time. Where the age gap is larger, societies are more likely to have more widows than widowers, though since the households are usually shared with the children, widowhood itself might not be as problematic (Bouman et al. 2012, p. 10). Reher, in his examination of persistent contrasts in "Family Ties in Western Europe" (Reher 1998), elaborates and supports these findings further by claiming that "[t]raditionally in Mediterranean societies, much of the aid given to vulnerable members of society came from the family or from individual charity, while in northern societies this was largely accomplished through public and private institutions" (Reher 1998, p. 209). The EMP, with its nuclear family and weak family ties, does not only use these institutions but is also the reason they were created in the first place (Laslett 1988, p. 170).

According to Dennison and Ogilvie, these arguments are an unsatisfactory but necessary attempt to embed the EMP into its institutional context for explaining the economic success of the west. When following these scholars, "whether a society experienced economic growth depended not on its marriage or family pattern, but on wider characteristics of its economy and institutional framework" (Dennison and Ogilvie 2013, p. 32). Dennison and Ogilvie turn the latter argument around, postulating that it is the given institutional framework that allows the EMP to have a share in either promoting growth or not. A more satisfying attempt to explain early western economic

growth would instead include "non-familial institutions that circumscribed both demographic and economic decisions during European economic development" (Dennison and Ogilvie 2013, p. 33). Going back again to Bouman, Zuijderduijn and de Moor's article (Bouman et al. 2012), another aspect of the EMP becomes apparent, and a critical revision of Laslett's nuclear hardship theory. Other than Laslett, the authors claim that, despite some hard times within its life cycle, it is the family of a nuclear household that is better prepared for hardship. According to the scholars, nuclear households, together with the EMP, lead to higher female participation in the labour market and provide not only the need for savings but the possibility. Related inheritance practices, such as passing on the property of living parents to their children and related caretaking contracts, provided people with the possibility to cope with hard times (Bouman et al. 2012, pp. 21f, 29). Kok et al., while referring to endogenous crises resulting from inner family misfortune, find the more flexible nuclear family better equipped for hardship: while living grandparents would create a 'safety valve' with positive effects on child survival through altruistic behaviour, additional kin compete for resources, resulting in negative effects on the survival of infants and children (Kok et al. 2011, p. 99). The main findings of the Kinship and Social Security project (KASS) are similar: they also suggest that differences in family and household arrangements are of great importance when it comes to economic factors. According to Heady et al., a larger kinship network[16] provides family members with a more stable basis. The nuclear family, however, "is better adapted to modern capitalism, in which most families do not own and transmit their own productive capital, and in which each person ideally enters the labour market in his or her own right, irrespective of family ties" (Heady and et al. 2004). As a result, in less kinship-oriented societies, and thus in EMP areas, non-utilitarian friendship is more pronounced, continuing to link people in a community of individuals rather than family units. A general geographical division of Europe in a weakly-tied northwest and a more strongly tied south, as found by Laslett and Reher (Laslett 1983; Reher 1998), is largely supported by recent studies (Mönkediek and Bras 2014). While strong family ties are usually associated with solidarity towards family members as well as moral and financial support in times of crisis (cf. Reher 1998, p. 208f), weaker family ties leave the more autonomous individual as the main agent when it comes to making decisions, making a living and setting up a family (cf. Reher 1998, p. 212).

[16] For an extensive analysis of families and their networking strategies see Fertig 2012.

Following this overview on the Malthusian paradigm and related theories, it is now possible to develop a set of hypotheses that will be tested later in order to help answer the research question:

H 1: The border triangle Belgium, The Netherlands, and Germany lies within an EMP area. The couples under research will deliberately carry out a preventive fertility check of marriage in all three communes when under economic pressure. *In other words, when economic conditions worsen, a clear postponing of marriage will become visible.*

H 2: Economic growth is expected to occur concurrently for the three communes during the 19th century due to their geographical proximity and the positive effects of the border paradox on exchange. However, this growth alone will not suffice for surpassing the Malthusian Trap. Instead, *the border situation allows us to assume that stress-attenuating institutions, such as savings banks and modern social security, appear at different times for the three communes. At one point in time, according to their emergence, the connection between economic stress and delaying marriage will disappear, first in one commune, then in a second and eventually in the third.*

H 3: When further analysing the different layers of society, and drawing on Malthus, who stated that "a large proportion of mankind" would suffer from worsening economic conditions, *we would expect the richer strata of society to marry independent of economically worsening conditions. For the lower strata of society, instead, we would expect visible vulnerability.*

H 4: As indicated in the literature review, the situation for farmers is a special case. Though it was shown that the niche argument is too simplistic, it was not completely rejected for farmers. Furthermore, richer farmers would be able to transfer money to their children for marriage before inheritance occurs. In addition to this, poor economic conditions are not necessarily bad for farmers, as *a farmer who still produces surpluses during bad harvest years would rather profit from such years as corn prices rise.*

H 5: According to the theory, it can be expected that stronger family ties had an advantage over families with weaker family ties in terms of cash flow smoothing in pre-industrial times, as a larger amount of capital would have been gathered under one roof. Vulnerability to economic pressure

should also be limited through the specific family life cycle (Laslett 1988; Bouman et al. 2012). Later, with industrialisation advancing and changing formal and possibly informal institutions (e.g. inheritance laws, poor relief, strength of family ties), the more weakly-tied families would be able to accumulate more capital and become less vulnerable to economic stress. *It can therefore be expected that individuals and couples with weaker family ties would have more difficulties to marry in the early years of industrialisation. Members of families with stronger ties could consequently marry earlier in this period. The connection between strong family ties and advantages to marry will disappear with the development of institutions that attenuate economic stress*.

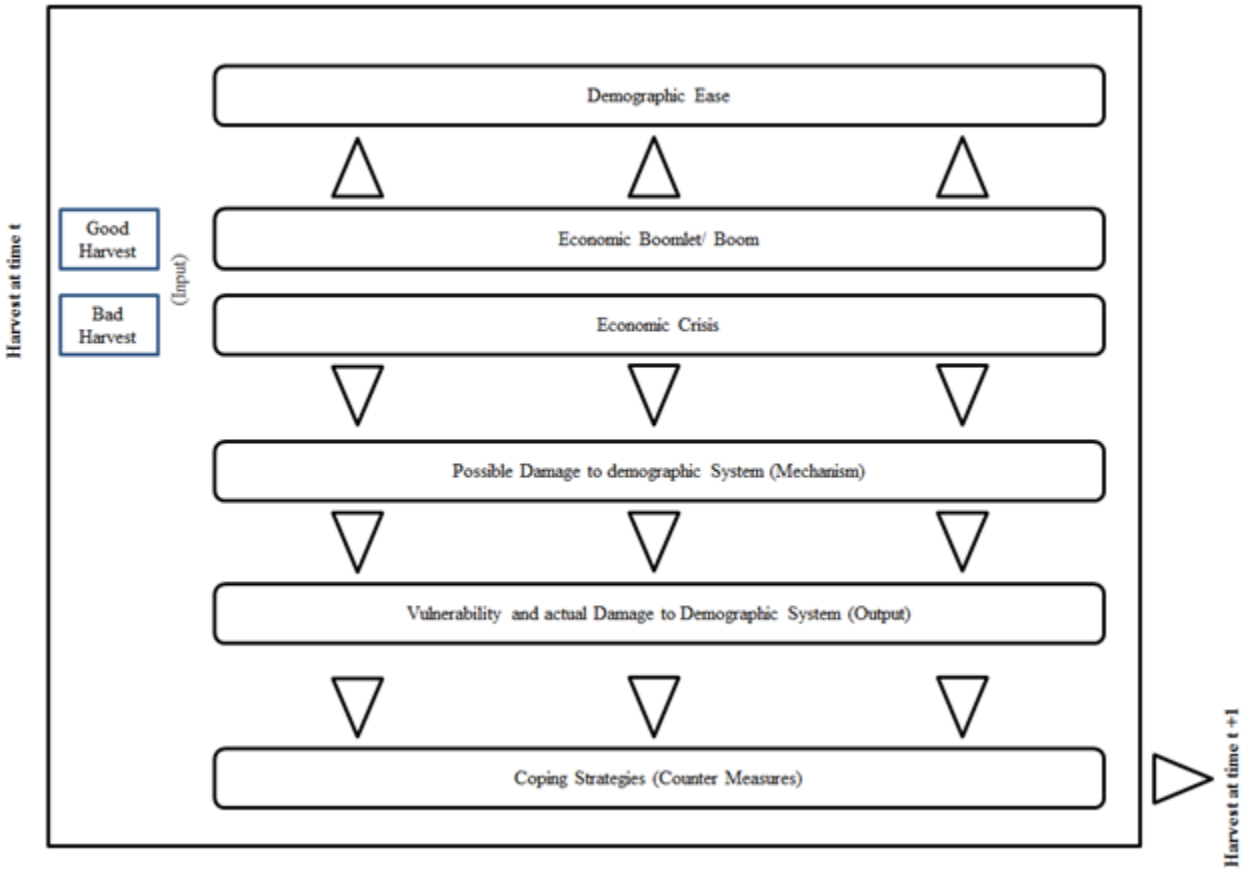
For the region under examination, as shown by Hajnal, it must be expected that families will predominantly follow the EMP. Observable differences within these EMP forms will most likely be found here, as the three different states the border triangle is embedded in will surely leave their marks on the ideal of a family. This ideal may of course vary within a specific country but still contribute to a certain overall tendency. As regional differences in economic organisation, production and necessary adaptation of families can be expected to carve out differences in marriage behaviour, similar differences must also be expected for family ties, patriarchy levels, and support from close relatives.

2.3 Analytical Framework

This section provides the reader with the analytical framework under which this study will be carried out. In order to frame an entire crisis process, it will be necessary to first describe it from a more general perspective on society as a whole, then to focus on individuals and couples, and their strategies for overcoming short term shocks. In this sense, we must be able to detect a possible crisis (input), understand how this crisis affects the demographic system (mechanism) and how vulnerable the demographic system actually is (outcome), and finally analyse their coping and resilience strategies (counter measures) before the cycle recommences.[17] Summarised in a figure, the framework should account for the following steps:

[17] The original idea for the design is derived from Krämer's studies on hunger crisis (Krämer 2012).

Figure 3: From Crises to Coping Strategies – an Analytical Framework



Source: own illustration, drawing on Krämer 2012

Figure 3 shows harvests (beginning with a harvest at time t) as the main determinant for categorising years as economically good (economic boomlet/boom) or bad (economic crisis). In good years, the demographic system will be at ease, as necessities will be available for a large proportion of the population. A bad harvest, however, causes an economic crisis that carries the danger of damaging a demographic system. If damaged, society strives for counter measures to prevent or at least lower the possible damage of another crisis (harvest at time $t + 1$). These counter measures are either installed by policy makers through formal institutions (e.g. public poor relief) or privately taken by individuals and couples through informal institutions (money lending from better off family members, or 'private poor relief').

When following this scheme, the concept of crisis used here will be applicable for testing the above hypotheses, and respective counter strategies for economic stress must be related to this crisis and not a side effect of general, independent societal trends.

2.3.1 Large crises and daily crises

The term crisis goes back to the Greek word "κρίσις" [krisis], a sudden event or issue which is followed by decision and judgment (Liddell et al. 2006[1996]). A contemporary speaker would probably refer to "any event that is, or is expected to lead to, an unstable and dangerous situation affecting an individual, group, community, or whole society […], especially when they occur abruptly, with little or no warning" (ibid.).

In "Crise de l'économie française Révolution […]" (Labrousse and Perrot 1990), Labrousse distinguishes between the "crise classique", subsistance crises before the industrial revolution, and modern economic crises. The 'old European world', according to Plumpe, lived at a subsistence margin and was constantly threatened by harvest failures caused by the climate (Plumpe 2010, p. 26). However, since the late Middle Ages, peasants that produced solely for themselves was seldom in Europe; instead, peasants usually sold surplus grain at local markets. Plumpe gives a short but demonstrative model of a pre-industrial crises: if prices remained high for a longer period, 'high quality food' had to be substituted for cheaper 'low quality food', which in turn would lead to begging, crime, hunger, diseases and ultimately death (Plumpe 2010, p. 28). If population growth exceeded the growth of agrarian productivity, less food per capita would be available per person, leading to decreasing survival chances for most individuals, pointing to the Malthusian Trap described above. In addition, with augmenting grain prices, producers of non-agrarian products would suffer from decreasing demand. Thus, according to Plumpe, even if crises of the old type were always related to food issues, the whole of society would eventually be affected.

However, as has been known since the works of Amartya Sen, natural circumstances leading to harvest failure alone do not suffice to explain why crises occur in one region and not in another, one similarly affected by draught, flood, or another natural disaster. Instead, according to Sen, distribution and failures of "exchange entitlements" are crucial to understanding the mechanism that leads to a crisis. Failure of entitlement here means a decrease in the exchange value of an individual's endowment (land, money, work, goods etc.) that can be traded on the market. According to Sen, it is thus a shift in exchange rates rather than a shortage of supply that leads to crises. "A recent example [of failures of exchange entitlements] was the 1974 famine in Bangladesh. The flood that destroyed the crop did reduce the availability of food, but the sharp decline in employment and the failure of exchange entitlement of labour was immediate, and the famine was made severe by that" (Sen 1976, p. 1275). During early modernisation, market failure

occurred relatively frequently in emerging markets (cf. Pfister et al. 2015, p. 91). When negative changes in entitlements occur, either through real wages falling below subsistence level or through a decreasing market income for home-producing craftsmen, a crisis is inevitable. An example from the period under research is The Weavers' Revolt in Silesia in 1844. This example shows a severe crisis not caused by food issues, but by constantly decreasing real wages.

Though with shortcomings, "first, a failure to recognize individuals as socially embedded members of households, communities and states, and second, a failure to recognize that famines are political crises as much as they are economic shocks or natural disasters" (Devereux 2009, p. 83), Sen's theory can be an auspicious one for developing a theoretical framework. If one adds further aspects to the economic ones, namely social and political ones, and takes "the importance of institutions in determining entitlements (at intra household or community level)" (ibid.) into account, it promises to be a sharp tool for detailed analysis.

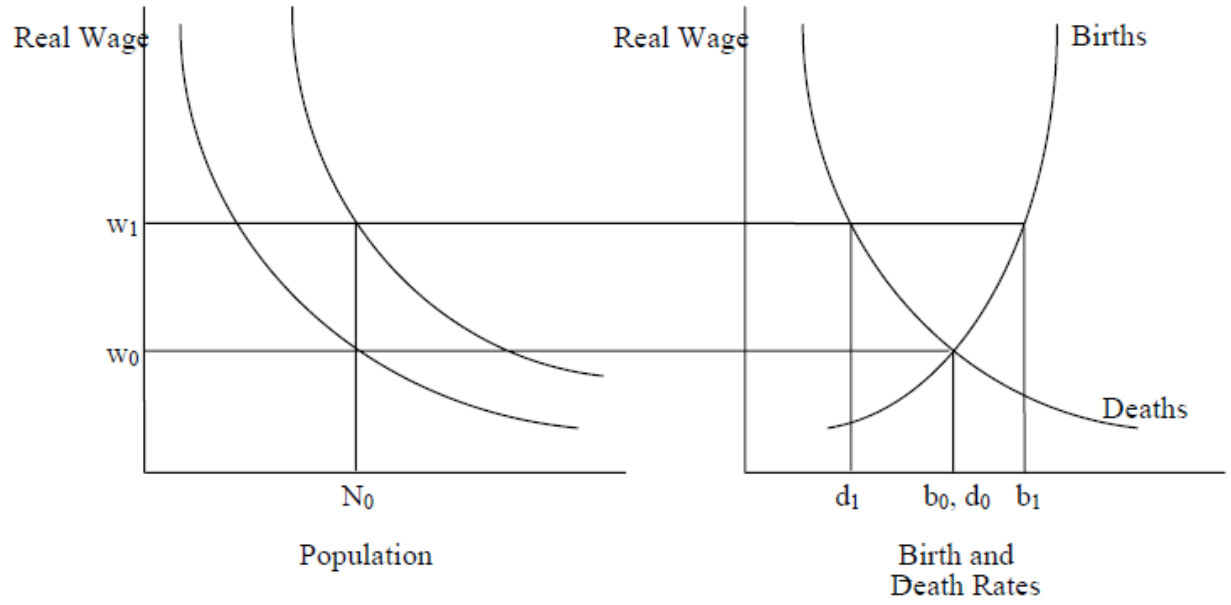
Crises in industrialised countries, or crises of the modern type, function differently. In short, expectations of profit cause investments and credit establishments, which in turn push both prices and interests. If expectations are too high, prices fall, credits remain unsettled, and this leads to bankruptcy, the disclosure of fabrics and mass unemployment. With prices and interest rates raising again, the cycle recommences (Plumpe 2010, p. 45).

So far, I have only spoken about large crises. Such crises are not particularly useful for observing daily lives, simply because they do not occur often enough. A study of large crises would reduce the study's scope to long run macro-economic analyses only. For a more micro-orientated analysis, the concept of short term economic stress seems more suitable: it can be seen as a 'small crisis' or 'short term crisis' that recurs randomly, and often enough to allow for both deconstructing long term changes in its character and analysing long term strategies of individuals on the family level. Furthermore, this concept permits the observation of demographic variables as endogenous, as individuals and families change their behaviour according to exogenous economic and meteorological phenomena (Weir 1984, p. 35). The methodological section (Chapter III) will provide the reader with the means for measuring short term economic stress. For now, let us proceed by establishing the theoretical framework and turn to the operational characteristics of crises or, in other words, their mechanisms.

2.3.2 Short term crises and demographics responses

The operational characteristics of a preindustrial food crisis are linked to a population's living standards. A food crises resulting from a bad harvest leads to a decrease in real wages, as nominal wages remain stable while food prices rise. As shown in 2.1, the link between living standards and demographic systems has been irreversible for many researchers since Malthus' time. Bringing these links back together, we are led to the Malthusian doctrine of positive and preventive checks once more. For studying short term crises and the demographic responses to them, it makes sense to go one step further and develop and illustrate a model that allows for quantitative comparison. As Weir affirms, "by comparing sensitivity in different historical settings within a common Malthusian model, a comparative history can be written" (Weir 1984, p. 27). Referring to Weir (Weir 1984), Guinnane and Ogilvie illustrate the doctrine Malthus developed in his essays in a model (Figure 4).

Figure 4: The Malthusian Model



Source: Guinnane and Ogilvie 2008, p. 47, orig. Weir 1984, p. 28

The model "consists of three equations: the first says that births are a function of the real wage. The second says that deaths are also a function of the real wage. The third says that the real wage is a negative function of the number of people using a given stock of capital and natural resources" (Guinnane and Ogilvie 2008, p. 47). Regarding the demographic character of the present study, the focus here will lie on estimating the central elasticities in the first two equations: the effects of real wage changes on life events, again narrowing down the scope to marriages. In Weir's analysis of the model, a higher "standard of living can be brought about only by shifts of the birth function inward or of the death function outward. Restraint of fertility will have the "admirable" result of raising living standards and lowering mortality levels" (Weir 1984, p. 27).

It is also important to briefly mention that Malthus, in contrast to this study, developed his thoughts on and for the entire economy. In the present study, the entities are smaller, and the analysis focuses on individuals and couples and their family formation behaviour. However, if one categorises these into comparable units, the model promises great possibility for contrasting demographic responses to short-term crises, both between and within the communes.

Still, over more than two centuries, the Malthusian doctrine has not gone uncriticised. From another point of view, one presented by Soviet agrarian economist Alexander Chayanov, there

appears to be a major shortcoming with this concept. Chayanov's studies of Russian peasants in 1915 (Chayanov et al. 1986) and the consumption-labour-balance principle derived shows that Russian peasants may survive with only a tiny market affiliation. While Chayanov accounts for the coexistence of both the capitalist and non-capitalist forms in Russia, many Russian peasants would work enough only to meet their needs. It is possible, therefore, that when harvests are good and grain prices increase and there is a chance to sell surpluses, the self-sufficient Russian peasant would decrease their workload instead of selling. They would thus deliberately miss the opportunity to sell for higher prices. In such a case, with the model illustrated above, it would not be possible to observe positive effects on high grain prices for certain grain-producing peasants in terms of, say, earlier marriage. On the other hand, a peasant family in any of these farms would have natural output limits. This means that when times are really bad (bad harvest, sharp grain price increase) the peasant family would not be able to satisfy its needs only by increasing the amount of labour considerably. The results of bad harvests, therefore, should still be observable. In any case, for the region under research it is rather difficult to find this type of peasant in the 19th century. As indicated above, the self-sufficient peasant has long since disappeared. The field site description in Chapter IV will provide further insights in this respect.

Another aspect is that not only do real wages influence demographic events, but "cold winters and warm summers affect demographic outcomes too" (Bengtsson and Broström 2010, p. 1). It is safe to say that cold winters and warm/dry summers directly affect harvest outcomes, but as the theoretical background has shown so far, these directly affect real wages and therefore demographic outcomes.

2.3.3 Vulnerability

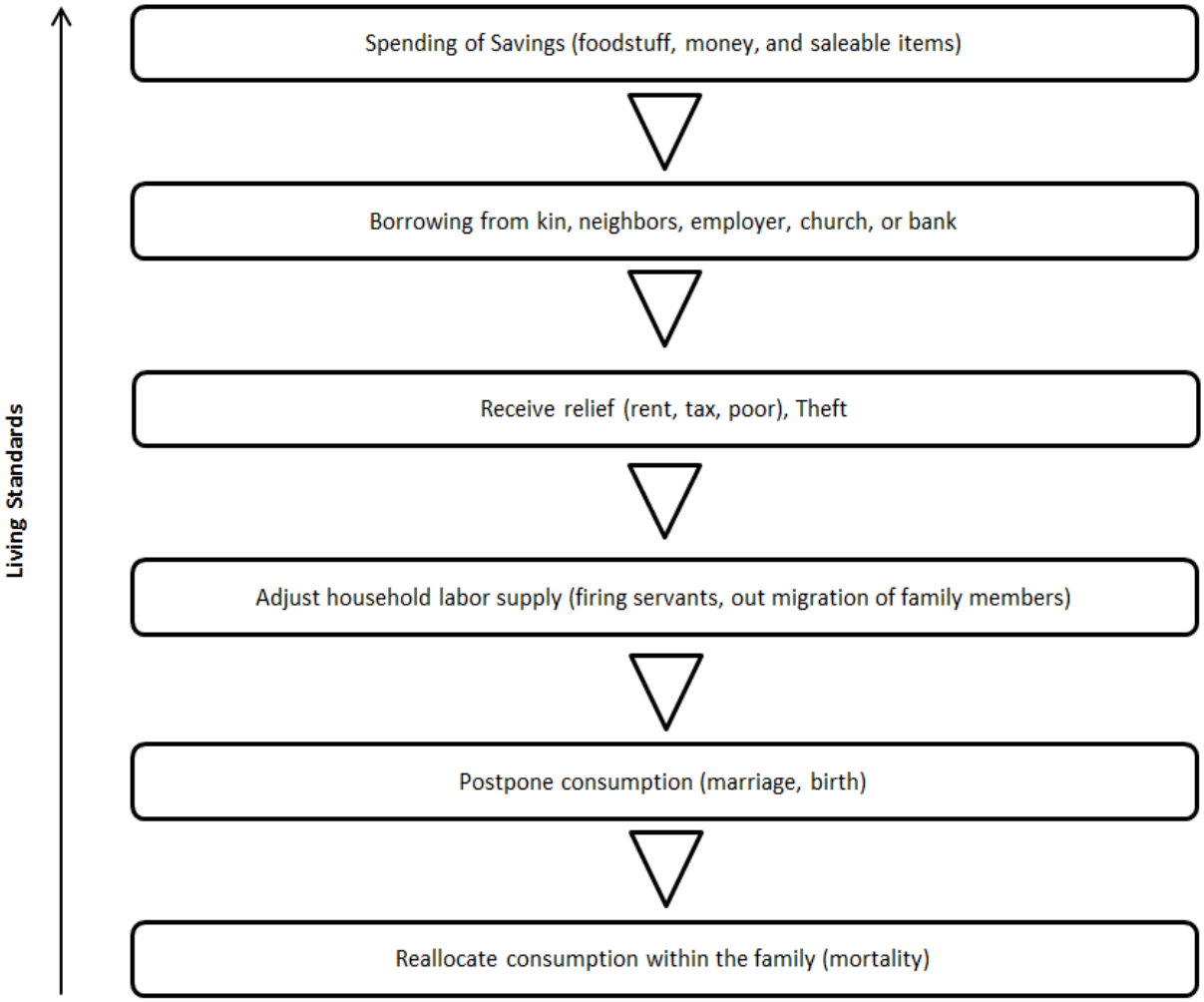
Detecting and describing crises is not enough for further analysing the impact of a crisis. We also want to know about the vulnerability of individuals and couples to crises: who is actually affected by which short term crises, to what extent, and why? In order to answer these questions, a systematic model that serves as a tool for structural analysis is needed. Krämer makes use of a specific analytical frame of vulnerability research, applied to explain Switzerland's hunger-crisis of 1817/18 (Krämer 2012, pp. 52-60). He provides a systematic model for the analysis of the hunger crisis which allows for historical research; and even though the present study is not about hunger crises in particular, crises in pre-industrial times are always linked to food (shortage of

supply, dearth, redistribution etc.) and might, if severe enough, lead to hunger. Therefore, Krämer's concept of vulnerability serves as a useful tool-kit for the intended analysis: for an analysis of vulnerability, the unit under observation first has to be determined. For this study, this is either an individual or a couple. The context (the geographical, political, and cultural environment of the unit) has then to be reconstructed. This would be the historical context for Würselen, Meerssen, and Sart. For the 19th century, it is a dynamic and constantly changing context. The "causal factor(s)" of that crisis and its/their duration of interference next have to be added. These have already been identified as higher food prices caused by bad harvests. It will be explained in depth how this will be modelled and measured in Chapter III. The sensitivity of a unit also has to be determined and measured. The measurement applied in this study will also be further discussed in Chapter III. The last step asks for the identification of coping and resilience strategies mainly depend on two things: 1) existing capital and the "architecture of entitlements" as well as 2) adaption actions, in turn shaped by the above context. This can be seen as the crux of the analysis. Through the identification of coping and resilience strategies, the hypotheses can be tested and the research question answered. Therefore, the analytical frame must now be extended to the coping and resilience strategies that individuals or couples apply to overcome short term economic stress.

2.3.4 Coping and resilience strategies

For the household, Bengtsson developed a six-step scheme which illustrates the strategies taken by households to overcome short term crises in the pre-industrial era.

Figure 5: Household Responses to Short-Term Economic Stress



Source: Bengtsson 2004a, p. 35; design slightly adapted, "Theft" added in later works

Following Bengtsson, this scheme can be understood as a 'social ladder'. The better off a household is economically, the less it needs to go down this ladder with reactions when taking measures to attenuate short term economic stress. In other words, households that are economically well off enough to buffer short term economic stress themselves will show the first reaction only: the family would simply spend some of their savings to overcome the short crisis and could, in this case, be said to have rather high living standards. The less well off the household is, the more counter-measures it has to take to cope with the crisis. Borrowing, receiving relief, and adjusting household supplies would be some such counter-measures. For the poorer strata of society, demographic reactions such as postponing consumption through delaying marriage or births and/or reallocating consumption within the household will be necessary to buffer the crisis. These households can be

said to have very low living standards, as the ultimate result might be a household too poor to nourish all of its family members appropriately. Deaths through disease or starvation might be the final consequence.

When explaining the scheme further in the interest of this study, it makes sense to ask for the institutions that *influence* each of the reactions simultaneously. Answering this question will reveal the institutions that are relevant for families trying to cope with economic stress. During analysis, it can and will be tested which institutions really work in an attenuating manner and which really trigger the emergence of heterogeneity in demographic decision making under economic pressure. Let us therefore elaborate on these institutions.

Spending of savings (foodstuffs, money and sellable items)

The most two obvious measures for overcoming high food prices are a) to consume stored food and b) to spend saved money on the now more expensive food. Additionally, c), sellable organic or material items could be brought to the market and converted into money or food.

a) Consuming stored food: simply consuming some stored food when food prices go up seems a trivial matter. However, when further deconstructing the possibility of food storage in pre-industrial times, as Bengtsson et al. point out, saving food was possible as food storage was generally expensive. Granaries had to be built and maintained – both requiring money. Furthermore, about 20% or more of the food put aside would be lost during the year (Will et al. 1991, see also Bengtsson 2004a, p. 35), either through deterioration or animals searching for food. Storing food was thus expensive in pre-industrial times and most probably not a reliable means of overcoming a crisis. These savings must therefore be expected to have had only very limited short term crisis-attenuating effects, if any.
b) Spending money: spending money was another option. It is obvious to say that in order to spend money, it has to have been accumulated before. What is not obvious, however, are the underlying institutions that made capital accumulation possible or easy:
    1. Farmland: in pre-industrial societies, rural farmland was the single most valuable resource for making a living. It was a. the most important means of production and basis for the creation of value, and b. property held by the peasant family and thus a sellable item in itself (cf. Bracht 2013, p. 91).

a. Farmland as a means of production: according to Bengtsson et al., both farmland holding families and farmland renting families would be able to cope with and even profit from less favourable harvests, as many of them were still able to sell their surplus (Bengtsson 2004a, p. 49). The higher prices would then enable the sellers to accumulate money for bad times. The situation worsened for all the non-land holding socio-economic groups, net consumers like artisans or day labourers, for they would have no choice but to pay the higher prices asked by the producers. Holding land is thus crucial for vulnerability to economic stress.
b. Property and property rights: farmland as property has a value in itself. In bad times, it can be sold and serves as security in times of crisis. A young couple that possesses a certain amount of arable land would thus be provided with both subsistence means and a back-up for hard times, a solid basis for navigating through future crises. Owning land is therefore an asset. Therefore, the question of how it is acquired is crucial for this study. The question of property rights is also crucial. Is the property you own really yours, or can it be taken away? Strong property rights permit individuals to innovate, enlarge production, and enable capital accumulation (North and Thomas 1973, Chapter I).

In a pre-industrial society, farmland was usually passed on to the next generation either through the death of the parents or inheritance contracts (see Dribe and Lundh 2014, p. 216, for the case of Skane as one example). However, there may be large differences in inheritance practices from community to community and especially in a border area, as shown in Coal and Wolf's study on "hidden borders" between the neighbouring St. Felix and Tret in South Tyrol. Informal laws and political self-conception divided practices in inheritance behaviour into two. Families of two different social classes emerged, one with relatively large estates (St. Felix) and the other with much smaller ones (Tret) (Cole and Wolf 1974, p. 235). This in turn could have strongly influenced the vulnerability/resilience to economic stress of the respective families.

2. Savings banks: the most promising research opportunity for capital accumulation in the course of the 19th century lies in the use of the then newly emerging savings banks. Bracht, drawing on Rothenberg (Rothenberg 1985), assumes that if we want to understand institutional change and new capital accumulation strategies for

households, an analysis of savings banks is the appropriate means (Bracht 2013, p. 214). The rise of savings banks on the European continent was the direct result of growing pauperism. A general lack of liquidity, hard cash, and savings possibilities made it very hard for most individuals to save money for bad times. The pedagogically-philanthropically shaped idea of the liberally thinking initiators of most early savings banks was to provide individuals and families with a means of saving cash, building up a hardship fund and thus navigating seasonal poverty more easily (Bracht 2013, p. 258).

c) Material savings: the savings that could be spent could have been of material character as well. In hard times, people would try to sell dispensable and sellable items, such as livestock and valuable belongings. Pawnshops would usually offer them deals. It is more likely, however, that people would try to re-buy their items rather than selling them properly: pawn-shops fall into the borrowing category, and will therefore be discussed as part of the next reaction (b*orrowing from kin, neighbours, employers, church or bank).*
d) Family organisation and family ties: obtaining a gift (in money or kind) from a distant uncle or an in-law aunt was more likely when family ties were strong (cf. Milardo 2010, pp. 6f). Though probably with a minor impact on savings as such, the strength of family ties and the attitude of family members towards each other might have also played a role in the savings behaviour of a family. As will be elaborated upon later, family characteristics and ties are more important for the reactions yet to be explained.

Understanding people's saving behaviour and the overall saving infrastructure, including inheritance, savings banks, family organisations and family ties is of great interest when analysing capital formation processes. However, throughout a large part of the 19th century, the accumulation of capital was impossible for most families, particularly during the years of Pauperism. If there were no savings for tougher years, families had to move one step down the scheme's ladder and borrow.

Borrowing from kin, neighbours, employers, church or bank: borrowing is an option for families that comes into play when the spending of savings is either not possible or maxed out. In this case people could a) informally ask kin or close non-kin such as neighbours and employers for food or financial help or b) ask credit giving institutions such as banks for formal credits.

a) Borrowing from kin or those close to them: "people lend knowing they will need to borrow next" (Deneweth et al. 2014, p. 90; drawing on Collins et al. 2009, pp. 48-52, 57). It is generally accepted that strong family ties are a valuable asset when financial or other help is needed (see e.g. Wall 1998, p. 64; Alesina and Giuliano 2007; Bengtsson and Mineau 2009). However, while weak family values and ties to kin may prevent sufficient help coming from relatives during times of hardship, strong family values and ties may stop people from becoming 'men of resources', hampering the entrepreneurial spirit of individuals, and reducing trust in and the emergence of public institutions and officials (Weber 2005[1904]; Banfield and Banfield 1967; Fukuyama 1995, see again 2.1).

   For estimating the chances of borrowing, it may be important to know if neighbour or employer loans were common when depicting the solidarity networks (Fafchamps 1992; Fertig 2009) of families. However, as it usually takes quite an effort to rely one someone else for help outside the family, it can be expected that financial help is first sought within the family.

b) Borrowing from banks: borrowing from banks is more formal. For the purpose of this study, it will be interesting to obtain a clear picture of which families get formal credit and for which (fixed) interest rates. Following Bracht again, research into early capital markets promises fruitful insights. The relationship of credit to property for nineteenth-century Westphalia is established by Fertig, claiming that "[p]roprietors of real estate did not have problems obtaining credit" (Fertig 2009, p. 503). The possession of farmland is a strong argument when asking a bank for credit. It may even have an influence on interest rates on loans, depending on the credit giving institution and the negotiation skills of the debtor (see also Bracht, Chapter 3.2). However, relying on credit was not an option for poorer families without property.

c) Pawnshops: pawnshops can be an official institution provided by the state or a privately owned local shop. The latter would still be very much dependent on the laws in place (e.g. property rights or credit interest rate) at the time. Pawnshops offered help when banks could not reach poor families. The poorer strata were only served by pawn brokers. Pawnshops were established in Europe in the late middle ages, and have been widespread ever since. In the first half of the 19th, they were one of the institutions that allowing borrowing money for short term financial distress with small securities. They were primarily used for "cash

flow smoothing more than anything else" (Deneweth et al. 2014, p. 99). However, the costs of selling and repurchase were relatively high (Wehber 2013a, p. 92), and pawnshops were established to rescue an already bad situation, not to prevent it, according to Wehber (ibid.; Ashauer 1991, p. 39).

In any case, if banks were not willing to give credit, if pawn shops could not sufficiently attenuate economic stress, and if the familial network was non-functioning or non-existent (either because of migration, death of parts of kin, or simply because the network itself was not sufficient in size or the family ties too weak), families would have to rely on public poor relief when economic stress occurred.

Receive relief (rent, tax, food):[18] if the private social network failed, the community (in the form of the parish or the state) had to step in to help. Means of reducing pressure could be a) to scale down family demand side through reducing rent or taxes, or b) to scale up a families supply side through allocating food or the money to buy it.

a) Scaling down the demand side: according to Bengtsson et al., for the Swedish Skane, rent reductions or relief were uncommon as housing was mostly provided by private individuals. The state, as a tax reducer, was more generous, and taxes could be paused but usually had to be paid at a later point in time, when things were better again (Bengtsson 2004b, p. 140). However, if families only had a small income, there were already low taxes for them to pay and a further reduction would not bring significant attenuation. In this common case, the supply side had to be increased through poor relief instead.
b) Scaling up the supply side: poor relief in 18th and early 19th century Europe was rather underdeveloped. In pre-industrial times, "European governments contributed relatively little money or effort to provision the poor in good or bad times. Poor relief, according to Western norms, was an act of Christian charity" and […] "when times were bad, local communities were often left to their own resources […]" (Lee et al. 2004b, pp. 86, 91). State aid was primarily given to the long-term needy (orphans, widows, sick, the elderly)

[18] Theft: another reaction/option to smoothening a crisis was through stealing. "A statistical analysis of crime figures in France and Germany before about 1870 established a remarkable correlation between grain prices and the number of thefts, demonstrating that people who normally made an honest living were forced to steal during hard times" van Leeuwen 1994, p. 17. Where possible, statistics on petty crime have been taken into account for the analysis.

and less to the general poor. All of this meant that when times in Europe were bad (ibid.), poor relief was merely a drop in the ocean. Thanks to the works of van Leeuwen on charity and poor relief (van Leeuwen 1993, 1994; Heerma van Voss and van Leeuwen 2012), we know that the Dutch poor relief system was much more organised than the rest of Europe, and that many people could survive a bad year "with a little help" (van Leeuwen 1993, pp. 337f). Still, at best, poor relief (in Amsterdam forvan Leeuwens study) accounted for 10% of a working class loan (ibid). Even the best European poor relief system only made survival possible, nothing more. Large positive influences on marriage therefore remain doubtable.

c) Family organisation and family ties: here, the family again plays an important role. Helping out a family member with informal, 'private poor relief' (food, some money, a place to stay) must have been as common in the 19th century as it is today. Most scholars agree that the strength of family ties would considerably influence the offering of support. With nuclear and communitarian families the two extreme points on a continuum of weak and strong family ties, the level of support, 'private poor relief', is expected to be lower with the former and higher with the latter (see again Wall 1998; Alesina and Giuliano 2007; Bengtsson and Mineau 2009). This is not to say that more weakly-tied family members do not support each other at all. When following Wall (Wall 1998, p. 64) and Kok and Mandemakers (Kok and Mandemakers 2012, pp. 20f), quite the opposite is true. However, being less affected by the family life cycle effects, 'private poor relief' is more constant the more the continuum approaches communitarian family types.

In any case, formal and informal poor relief was often not a sufficient option for the less fortunate. With an underdeveloped public poor relief system, depending on the severeness of the short term crises, these families would have to adjust their household/family labour supply.

Adjust household labour supply (firing servants, out-migration of family members): adjusting household labour supply can be accomplished either through a) firing servants or b) the out-migration of family members to places where the migrant would hope to find work.

a) Firing servants: the institution of life-cycle servanthood was established in Northwestern Europe, and firing servants was a commonly-applied way for households to reduce non-

essential labour.[19] It is the logical consequence of either deliberately reducing expenditures or no longer being able to pay them. With the genealogical data used for this study, a reconstruction of compete households and their members was not possible. Thus, while firing servants certainly was a means of smoothening a crisis, in this study it remains a phenomenon that will be little traceable in the later analysis. Instead, life-cycle servanthood will be treated as a variable that is inherent to the Northwestern European setting that the Border Triangle of Belgium, The Netherlands, and Germany is embedded in, but that might differ in form and size.

b) Migration: while migration has many push-factors (see e.g. Lee 1966), the given push factor for the migration in this study is the short term economic crisis which could not be attenuated otherwise. The migration of family members was a commonly-applied way to reduce pressure on family expenditures (Dribe 2003, pp. 272f). Superfluous labour forces could be reduced and less mouths were left to be fed. The easing of pressure made household consolidation possible for those who remained (Vliebergh and Ulens in: Alter et al. 2010, p. 200). In times of hardship, the will to care for one's own family members could decrease for certain individuals (van de Putte et al. 2005, p. 198). These individuals, as a consequence, were forced to search for other coping opportunities. The connection between family organisations, ties and their ability to provide for their members (see the point "borrow from kin or close kin" again) and migration is thus established here. For Sweden, Dribe shows that migration was not an effective means of coping with crisis until 1860, when long distance migration began to dramatically increase (Dribe 2003, pp. 294f). Sweden was very late to industrialise, and several of Sart's studies have shown that migration was indeed a means to at least relieve the pressure for those who stayed (Alter et al. 2004c, p. 192; Oris et al. 2014, pp. 180f).

   Migration also has pull factors. According to Idyorough, these are general striving for better conditions, food, sex, and security (Idyorough 1998). Though Idyorough mainly speaks of long term or permanent migration, short term migration might also be triggered for the same reasons. However, as adjusting the household labour supply is just a causal

[19] This and the following statement could not be found explicitly in the literature. However, they can be derived logically from the descriptions of practices of hiring and firing of life-cycle servants in Northwestern Europe. See e.g. Laslett 1977a; Lundh 1999; Bengtsson 2004a, p.54.

reaction to short term economic stress, it becomes clear that the above push factor remains in focus.

In any case, analysing the actions of adjusting household labour supply requires the reconstruction of both the character and the degree of liberalism of the labour market. Only free people on liberal labour markets are able to seek work elsewhere and choose to move. Related to this is the indispensable identification and definition of the prevailing "ecotypes" (Mitterauer 1992, pp. 142–149), the economic and socio-economic structure of each community under research. Only through this will it be possible to entirely reconstruct the labour market. In order to do so, female labour market participation has to be included too.

c) Family organisation and family ties: it is important to note that those who migrate, depending on the distance, often weaken their family ties or even completely lose their family network and corresponding support. This might have implications on reactions to economic stress again, most likely negative ones in the short term.

If all the counter measures mentioned above are either impossible to take or insufficient for attenuating the crisis, the demographic system itself will be affected, along with the preventive check described in 2.1. Families would then decide to postpone consumption.

Postpone consumption (marriage, births): according to Bengtsson's scheme, postponing family consumption would be regulated through a) delaying marriage, therefore before the family would be established, and b) postponing births.

a) Delaying marriage: the EAP research in the volume "Similarity in Difference" focuses on two dimensions to understand marriage behaviour in Eurasia, namely "Incentives – Disincentives" and "Opportunities – Constraints" (Kurosu and Lundh 2014, p. 33). For the purpose of this study, the latter perspective is of relevance, as the interest lies in the results of the constraints promoted by economic pressure and the opportunities given by institutions. The financial costs of marriage play a decisive role in the Malthus-Hajnal paradigm (ibid.). In the area under research, marriage was expensive as a new household had to be established along with marriage. Additionally, dowry was quite common in Western Europe (ibid.), meaning more additional costs. For the majority of couples,

external economic conditions had to be favourable to make a marriage possible. This frequently not being the case, the start of reproduction often had to be delayed.

b) Postponing births: this paper will stay with marriage behaviour as the main object of study. However, for completeness, it must be added that economic stress does, of course, not only occur before a couple marries. It is much more likely for the couple to experience economic stress during marriage, as divorces were quite exceptional in the 19th century. Couples would deliberately reduce fertility through "spacing", or stretching birth intervals. This could be achieved through simple abstinence and was, according to former research, widespread in Western Europe (Bengtsson and Dribe 2010, p. 110; Szreter 1996; van Bavel 2004). Another possibility of reducing the overall family size was the simple "stopping" of having children. However, stopping should probably be seen more as a means of achieving the desired family size, and not as overcoming short term economic stress.[20]

If all attempts to fight economic stress were in vain, the positive check strikes inevitably and the family had to reallocate consumption.

Reallocate consumption within the family (mortality): the final means for a family to cope with economic stress is the reallocation of consumption goods inside the family's closest circle. In other words, food would have to be redistributed. Unavoidably, this left families with some members possibly starving, either through disease caused by malnutrition or from hunger. However, for the reasons mentioned under 2.1, the positive check is mentioned for completeness but will not be included in the later analysis (for extensive research on mortality responses to economic stress, see Bengtsson et al. 2004).

Family organisation and family ties: before going on to summarise the theoretical framework in a comprehensive scheme, with *family organisation and family ties* informally influencing most, if not all reactions to short term economic stress, it also seems necessary to include this informal 'super' institution in the analysis. Indeed, the researchers of the Kinship and Social Security (KASS) project of Patrick Heady confirm the far-reaching impact of the family as a source of

[20] The division of the preventive check in "starting", "spacing", and "stopping" is again derived from Knodel 1987.

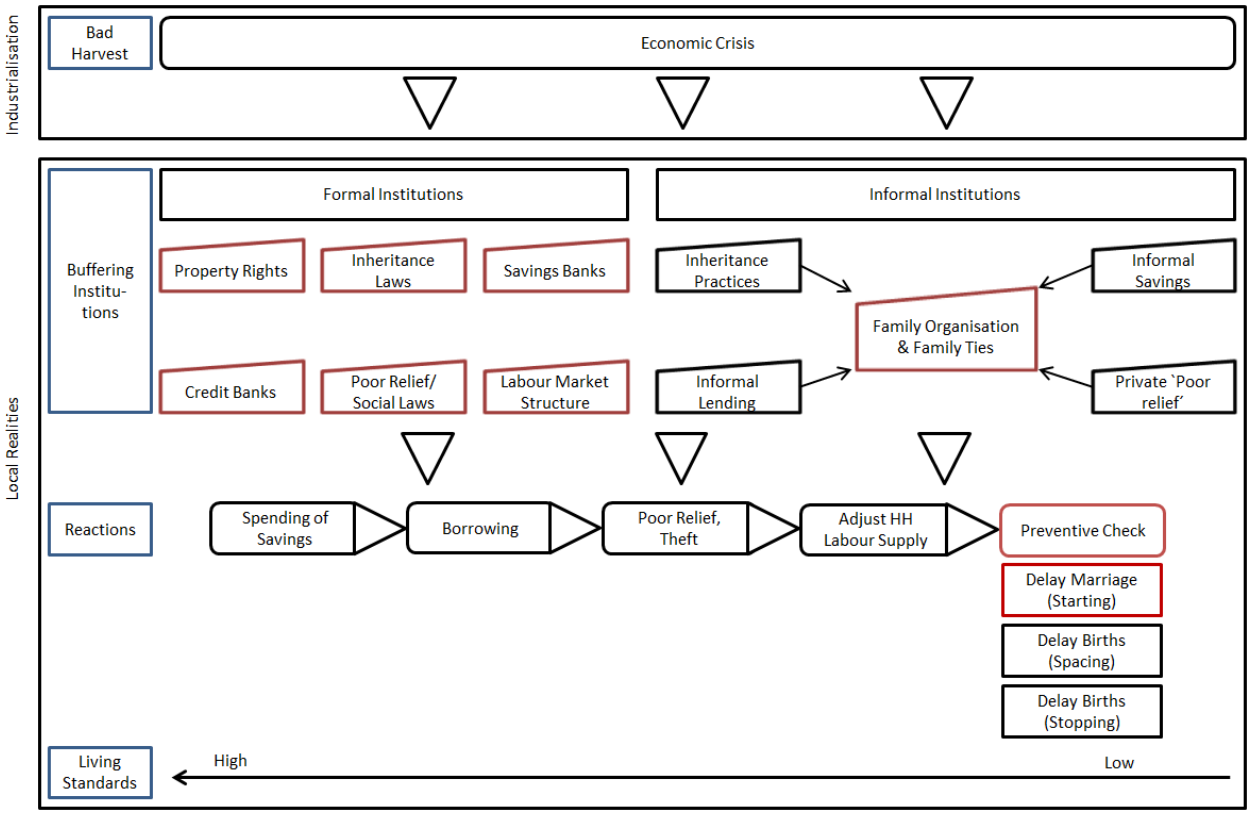
security and mutual assistance provider: “[l]ike the state, the family provides care, education, financial support, and help in finding employment” (Heady and et al. 2004).

However, the family “also influences (and occasionally controls) choices involving career and marriage” (ibid.), the latter potentially hindering marriages of free choice. A study of Frost’s, of 875 court records and newspaper accounts of Victorian England, focusses on marriage behaviour in the (upper) working and lower middle classes. In her analysis, relatives would try to prevent (especially economically) unsuitable marriages again and again (Frost 1995, p. 80). For one case from the upper class of late 18th century England, however, according to his study on marriage motivations, King finds the family to be important for courtship but much less so for marriage. With this, he stresses the (future) couple's role as the main actor in the process of marriage and its power in decision-making. He backs up his argument by bringing up the lack of interest for dowry on the part of the future husband (King 2010, p. 20).

In either case, the family and the strengths of family ties are of great importance to the present analysis; they serve as the basis for almost all informal economic stress-attenuating institutions as the main social security provider and foster or hinder marriage itself. The latter also partly depends on hierarchy levels. This 'super’ institution, therefore, needs to be included in the analysis and approximated as far as possible into the statistical modelling.

It is now possible to connect Figure 5 with what has been worked out in this Analytical Framework section, and to sum up the reactions to short term economic stress and the formal and informal institutions that can be expected to have an attenuating function to it in one scheme. This scheme will constitute the analytical red line along which the analysis of this study will be oriented:

Figure 6: Economic Stress, Attenuating Institutions, and Demographic Reactions



Source: own illustration

The scheme shows the trigger for a short term economic crisis – a bad harvest – which is embedded in the phase and level of industrialisation of each commune under research. Local historical realities determine which formal and informal institutions are in place to help to attenuate the reactions of the couples to that economic crisis. These institutions change over time, and will therefore have to be reconstructed in a continuous manner. While economic stress-attenuating institutions (red) will be analysed through classical qualitative historical research, the aim is to measure or propose respective measurements where possible through proxies in the upcoming statistical modelling. Wherever possible, the institutions depicted in Figure 7 will both be reconstructed and measured. Because it is not possible to measure informal institutions in a satisfactory manner, the informal institutions above will be summarised in the 'super' institution of family organisation and family ties.

However, of all these institutions for answering the research question, only potential differences in the timing or character of institutions are of interest. For instance, if the historical reconstruction

revealed that property rights were identical in each of the communities over the entire 19th century, this institution cannot not serve to explain differences in individual and couple demographic decision making. It shall thus left out of further discussion. The reconstruction of the historical context must therefore be the starting point for analysing the institutions in our communities, and serve to determine which institutions should be left from further discussion. The final step will be to let relevant institutions interact with marriage behaviour under economic stress.

This theoretical framework "demonstrates definitively how tributary the solutions [to overcome economic stress] adopted by the families and individuals are in cultural, political, social, and economic contexts" (Fontaine and Schlumbohm 2001, p. 17). With this theoretical framework in mind, let us now move on to the methodology.

III Methodology and Data

As indicated in the introduction, the upcoming analysis will be divided into two parts: a mainly qualitative one which reconstructs the historical context and institutions of the three communes, and a purely quantitative one which will test the hypothesis through descriptive statistics and event history analyses. With this combined approach, it will be possible to state the differences in the demographic responsiveness of individuals and couples to economic stress, and to explain why such differences exist. This methodological set-up also makes the study comprehensible, easily repeatable and refutable should other data reveal different results. Chapter III will provide the reader with the methods used for the historical reconstructions and statistical measurements. Additionally, this chapter presents and critically discusses the data employed.

3.1 Reconstructing Historical Contexts and Economic Stress-Attenuating Institutions

The reconstruction of the historical settings of the three communes under research will begin with the reconstruction of the broader historical context which the Border Triangle is embedded in. The three communes will then be observed in more detail. This approach ensures a better understanding of the reconstruction of the institutions developed above: the aim of reconstructing the broader historical context was mainly achieved through the classical review of (regional) literature and the gathering of additional economic and demographic data during fieldwork. Several field work trips in the Border Triangle were included in the period of study, spanning around one week to one month.

The reconstruction of local histories and institutions has been more challenging: though there are some local histories written in book or article form, as will be shown, the detailed information needed for this study could often be obtained after the gathering of small-scale, local primary source material. Much of this material could only be found from discussions with and suggestions from locals. One part of the fieldwork was therefore to travel several times to Würselen, Meerssen, and Sart, talking to locals interested in their history. In addition to this, three main archives were chosen for the further gathering of local material, each for one field site respectively: 1) the Kulturarchiv Würselen for Würselen, 2) the Regionaal Historisch Centrum Limburg for Meerssen,

3) and the Archives de l'État à Liège for Sart. Their inventories promised the opportunity to find the material for the analyses. Wherever possible, this material should either support or refute historical descriptions, and/or allow for a more detailed description of local historical realities in the 19th century.

3.2 Measuring Living Standards through Economic Stress and Its Impact on Demographic Behaviour

Recalling again the concept applied here, which defined living standards as "the level of wealth, material goods and necessities available to a certain group in a certain geographic area" (see Chapter 2.1), it is self-evident that such a concept is strongly related to its measurement. In the literature, we find three major strands of ways to practically measure living standards in the past: 1) economic measurements through income and consumption, 2) anthropometric measurements such as height, and 3) economic and demographic measurements. These three measure living standards by overcoming short-term economic stress.

1) Economic measurements: income, consumption

The first and most commonly applied measurements are economic in nature. "Gross domestic product (GDP) per capita is the most common measure of living standards", "[…] wages reveal the standard of living if they are compared to the price of consumer goods", and "[t]he most practical indicator is the real wage" (Allen 2005, p. 112), as this represents an individual's ability to access goods. Real income/real wages are obtained by dividing nominal income by a cost-of-living-/consumer-price-index,[21] constructed through the prices of these goods.

This measurement is 'distributionally sensitive', meaning that it measures the standard of living of those who really earn a wage (mainly workers) only (Allen et al. 2005, pp. 7f). A measurement of living standards of this kind would exclude the parts of a society that do not receive a salary, such as the unemployed, the elderly, or land-holding peasants. For the purposes of this study, where the

[21] For the procedure of constructing such an index in the line of thought of the article mentioned here, see Allen 2001, pp. 419–431.

entire society is to be analysed, real wages alone would be inappropriate for measuring the living standards of a population as a whole.

2) Demographic measurements: height

A second approach would be to measure living standards through purely demographic information: height and life expectancy are strong indicators for both the well-being of an individual throughout their life and the well-being of a certain group of people (individuals, couples, regions, nations, societies, etc). In his international overview of heights and real wages in the 18th and 19th centuries, Baten affirms general assumptions about the causal relation between lower real wages and lower height. "The real wage – height relationship is apparent in most of the cases we considered with the exception of the U.S. and Great Britain between 1820 and 1840" (Baten 2000, p. 75). Steckel agrees, and describes height as a useful measurement of living standards "which can be compared to or with other familiar examples such as income, wages, inequality or life expectancy" (Steckel 2008b, p. 21).

However, there are a couple of draw-backs when taking heights as a proxy for measuring living standards in the past: measurements are highly selective in historical sources as only men were measured (army conscripts or, sometimes, detainees). This shrinks the group of individuals either to young males (army conscripts) or poor and young males (detainees[22]). The only points at which an individual was measured that are possible to research from army sources is at the biological growth phase, for obvious reasons.[23] Still, some scholars claim that growth is more or less complete by the time of draft. Kok et al. find that an additional growth of only around five centimetres occurs from 19 to 25 (Kok et al. 2016, p. 101), and that even if this was not so, these heights would indicate living conditions in adolescence. However, in research on height, women remain out of focus. As Fogel pointed out in 1989, height "is rather a net than a gross measure of nutrition" (Fogel 1989, p. 44). It may be an increased disease load that accounts for a possible decline in stature, "which in turn might be only weakly related to nutrition and standard of living" (Bengtsson and Dribe 2002a, p. 9).

[22] Throughout history, young males have committed the majority of crimes. For Germany, see Oberwittler 2016, Table I.

[23] The common average draft age is under 20 (Kok et al. 2016, p. 101; Koerhuis and van Mulken 1986). This statement is valid for the main share of detainees too, Oberwittler 2016, table I.

For these reasons, height is better when not used as a measure of living standards but as a proxy for the "biological standard of living" (Steckel 2008a, p. 129), a concept that has an overly narrow character for this study. In order to be able to cover all the layers of society and different age groups in one approach while maintaining the possibility to start off at the individual or couple level, we will have to find more suitable indicators of living standards.

3) Economic and demographic measurements combined: the ability to overcome short-term economic stress

A third method for measuring living standards was developed in 1993 by Tommy Bengtsson. Bengtsson combines longitudinal micro-demographic data with macro-economic data for analysing demographic responses to short-term economic stress within different social groups (Bengtsson 1993; Bengtsson and Dribe 2002a, p. 14). What is new here is the idea of using demographic micro data on the individual and household level. In 2002, in addition to the more traditional measures, Bengtsson and Dribe proposed this new approach for the measurement of standards of living in Sweden, written in English. The focus lay on how individuals and reconstructed families responded to short-term economic stress in preindustrial societies: "[w]e measure the standard of living through the ability to overcome short-term economic stress. If you cannot fulfil your long-term plans – to marry, have children and survive – in face of acute short-term changes in the environment, you can be said to enjoy a rather low standard of living" (Bengtsson and Dribe 2002b, p. 11). In 2002, when the 'ability to overcome short term economic stress' was still a new indicator of living standards on individual or household levels, the focus of the researchers was on measuring mortality responses to short-term economic stress. When comparing different demographic responses to short term-economic stress, such as postponing marriages and births, these can reveal much about the vulnerability of individuals and groups, and thus their living standards. In their 2010 and 2014 volumes, the EAP researchers showed how fruitful this approach can be.

The approach was criticised by Saito for its inconsistency in measuring economic stress (Saito 1998, 2005). In my analysis, comparable economic stress measures will be applied as far as possible. However, as mentioned in the introduction, disproportionate information in a comparative historical study is more a norm than an exception. As long as the researcher is aware of this, results can still be obtained and compared adequately. A second major critique concerns

the assumption of the EAP researchers that material well-being was 'roughly similar' in the regions researched (ibid.). According to Saito, this was not the case. In our study, this critique is countered by the fact that there is only one region under research, a region deliberately chosen to minimise any cross-regional differences of any type.

With this approach, the problem of how economic stress can be simulated without data on real wages. The next section will therefore detail the most suitable way to do so for this study.

Simulating economic stress: an ideal combination of economic and demographic variables to measure the ability to overcome short term economic stress would be to use real wages and demographic responses. For modelling the economic stress of an entire population, it will be important to find a proxy which indicates economic stress for all the individuals, not only for those who earn a wage. In a study on patterns in fluctuations in fertility, nuptiality, mortality and prices in pre-industrial Europe, on an aggregate level, Galloway, like many before him[24], advocates the following one: "[a]nnual variations in grain prices are used as a proxy for annual variations in the standard of living […]. Over the short term, fluctuations in the price of grain were the primary determinants of variations in the real wage: we can observe empirically that from year to year nominal wages rarely fluctuated, while prices, which were dominated by grain, tended to vary substantially" (Galloway 1988, p. 276). In Galloway's studies, fertility is "significantly negatively correlated with grain prices in England" (Galloway 1986, p. 284) and "highly sensitive to grain price fluctuations (the short-term preventive check) in most of pre-industrial Europe" (Galloway 1988, p. 298). Additionally, "high grain prices can lead to increased mortality in a number of ways" (ibid.).

"[F]oodstuff in general would account for around 83% of the total budget of a family" (Bengtsson 2004a, p. 45; referring to Myrdal 1933, p. 115). Food prices were thus *the* main cost driver in a family's budget, and must have had a considerable impact on their financial resources. Bengtsson and Dribe propose a 10% increase in food prices as a logical, strong indicator of acute short term economic stress at a time when most people lived on the margin of subsistence. In their model, the authors combine time series of food prices for simulating exogenous short term economic stress, and demographic data for analysing demographic reactions in the frame of event-history analysis

[24] Galloway names 39 scholars who use the same approach to measuring standards of living again, and even more in a 1988 study (Galloway 1988, pp. 278f).

(Bengtsson and Dribe 2002a, p. 21). With this approach and the computer techniques available, it is possible to go beyond aggregate descriptive statistics and apply small-scale probability estimations which provide far more detailed results.

Other studies propose yearly climate time series (de Vries 1980, p. 627), for obvious reasons, or crime (Hay 1982; Lawson 1986) as possible proxies for bad harvests and/or economic crises. Indeed, economic stress may mean something very different at the same point in time in England, Sweden, Würselen, Meerssen, or Sart. It is therefore important to identify what exactly economic stress means for each of the regions being researched before it can be measured as indicated above.

3.3 Event History Analysis

Event history is, by definition, dynamic. Study objects are followed over a certain period (time) and furnished (or not) with information about changes in certain statuses of interest (events). The concept of the time it takes for a certain event to occur (time to event) plays a key role here. In this concept, *time* denotes the outcome variable 'survival time', *event* a 'failure', "because the event of interest usually is death, disease incidence […]" (Kleinbaum and Klein 2012, p. 4). However, as Mills states, "[t]he goal of these models is not only to examine the effects on the time until an event occurs, but also to assess the relationship of survival time to explanatory variables" (Mills 2011, p. 2). These would be our formal and informal institutions.

Due to the specific features of event history data, event history analysis has to take censoring and truncation into account. Censoring usually occurs when an observation is incomplete, in the sense that it couldn't be observed for the entire study length due to some *random cause*. With historical data, this usually happens when a study object moves and can't be followed. Truncation instead describes the incomplete *character* of the observation: a systematic selection process due to the design of the study.[25]

In order to make these event-history dynamics comparable for analysis, it is more useful to look at risks of the event for an individual/a group *relative* to each other, instead of their *absolute* risks. As indicated above, this can be done through event history analysis (or, to use the more common

[25] For a more detailed discussion on censoring, see Broström 2012, pp. 5ff.

name, survival analysis). Relative risks of time to event can be measured via the widely-used Cox Proportional Hazards Models (Cox 1972), called Cox Regressions from here on for the sake of simplicity (even though, in the strictest sense, the classical Cox Regression is a step function rather than a regression). Cox Regressions are most commonly applied in clinical trials for human subjects, in order to measure and compare survival chances for a group of treated and a group of non-treated patients (control group). Generally speaking, a Cox Regression measures the probability P per time interval T for a certain event A to occur for a certain individual/group J, relative to a base line hazard h_0 of the controlled individual/group I. These results estimate the influence of a certain parameter (such as treatment) on the survival time of a patient. The 'patients' in this study are individuals and couples in the 19th century under stress, while the 'treatments' are the stress-attenuating institutions.

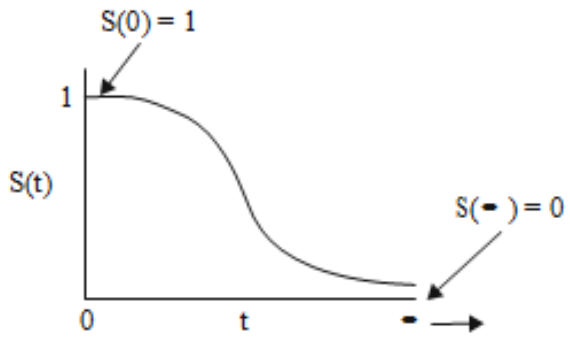
3.3.1 Modelling an Event History Analysis for Marriages

There are different ways to introduce and describe Cox Models. For this study, it will be of no use to focus on mathematical proof. Instead, the focus will lie on practical application issues for the historian. The following approach to event-history analysis, mostly provided by Kleinbaum and Klein (Kleinbaum and Klein 2012) and Broström (Broström 2012), seems to be the most easy to grasp: in this study, the overall aim is to explain what determines the emergence of differences in responsiveness to short-term economic stress. As mentioned earlier, for comparison it is best to look at effects on time to failure or timespans to events *relative* to each other. According to the theories presented in 2.1 and the theoretical framework in 2.2, the events of interest for analysing preventive demographic behaviour will be marriages.

An illustrative example is the modelling of the effect of a mother's death on marriage probability (or, to be more precise, on time to marriage) under economic stress. Together with variables such as the death of the father, the effects of this variable on marriage timing may tell us more about close family ties as stress-attenuating institutions. With the death of the mother having a negative impact on the timing of marriage for the next generation, clear indications for a supporting mother and close family ties are found. Suppose that there are 100 people whose mothers have recently died, and 100 people whose mothers are still alive. We would like to know their *relative risks* (relative towards each other) of marrying throughout the period observed, their entire life. For simplicity, one function of each group would have to be established separately, with the first set

as a reference, asking the probability of surviving (not marrying, in our fictitious example) past *t*, with $t > 0$. Expressed in formula this would be

$$S(t) = P(T \geq t), t > 0$$



Source: Kleinbaum and Klein 2012, p. 10

That is the survival function. It is a cumulative distribution function which measures the probability that, if an individual survives (does not experience the event identified) to t, they will experience that event at the very next moment. t0 represents an origin, the beginning of a certain study or the start of each time interval separately. S0 would thus represent the probability that an event does not occur with the start of the operation. The more time passes, the less the chances of survival (not marrying, in our fictitious example) are. Its properties are thus

$S(t) = 1 \text{ for } t = 0$
$S(t) \to \text{as } t \to \infty$

The failure function (or density function), the chance that failure occurs at exactly one moment, is by definition complementary to the survival function and thus written

$$F(t) = 1 - S(t)$$

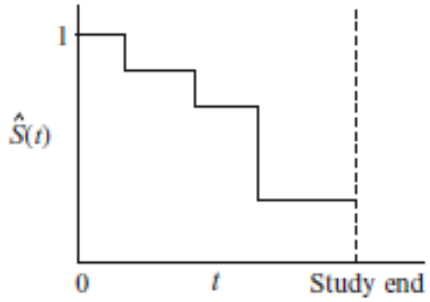
Both functions are needed to apply Kaplan-Meier estimators and plots, which are used to make two or more groups visually comparable.

3.3.2 From Kaplan–Meier to Cox

Kaplan-Meier's "Nonparametric estimation from incomplete observations" (Kaplan and Meier 1958, p. 11) are the logical next step for an analyses, as proposed here. Unlike many commonly used data analyses procedures, with Kaplan-Meier estimates it is possible to deal with the problem of censoring, as mentioned above. Right censored data can simply be left out of the equation without distorting the overall picture. Kaplan-Meier models estimate the survival probability of an individual/a group by dividing the survivors at time interval t by the number of individuals at the start of the observation t0 and multiplying them for each time interval in order to obtain the conditional probability. Put into a formula:

$$\hat{S}(t) = \frac{r_1 - d_1}{r_1} \times \frac{r_2 - d_2}{r_2} \times \ldots \times \frac{r_i - d_i}{r_i},$$

where r(k) is the number of subjects still alive, before time t, and d(i) indicates the number of individuals who died at time t(k). Kaplan-Meier estimates thus apply the survival function $S(t) = P(T \geq t), t > 0$ and multiply the survival probability of each separate interval with the former, obtaining a *conditional* probability. This gives a monotonically decreasing cumulative distribution function, which in practice looks like this:



Source: Kleinbaum and Klein 2012, p. 10.

Kaplan-Meier graphs essentially compare one control group (such as non treated angina patients) and another group (such as angina patients treated with antibiotics). In the example above, these are the individuals whose mothers died as the control group, and those whose mothers are still alive as the group to compare with.

Kaplan-Meier estimates are non-parametric models. This means that they don't assume a fixed amount of parameters. The structure of the model is thus not pre-defined, but determined by the existing data. No assumptions are made about the probability distribution of the variable being researched. However, there are some fundamental shortcomings with non-parametric models, as they cannot take the effect of several covariates at the same time into account. They are therefore most often used for simple models with a more descriptive interest. Furthermore, while Kaplan-Meier estimates focus on an event that will *not occur*, as it measures survival rates, in this study, the focus is on the *risks* or, more precisely, "the instantaneous potential per unit time for the event to occur, given that the individual has survived up to time t" (Kleinbaum and Klein 2012). This *hazard rate* is calculated by the *hazard function* $h(t)$, written as

$$h(t) = \lim_{\Delta t \to \infty} \frac{P(t \leq T < \Delta t \mid T \geq t)}{\Delta t}$$

or, applied, as

$$h(t) = \frac{\text{number of individuals experiencing an event in interval beginning at t}}{(\text{number of indivduals surviving at time t}) \times (\text{interval width})}$$

which essentially sets the conditional probability rate of failure at an instant t, given that the individual survives up to time t, by dividing the probability of a certain event occurring at a short instance, if surviving the last time interval, by the survival probability.

When introducing covariates, such as the death of the mother, the *base line hazard*, which is a linear function of a set of k fixed covariates that is exponentiated on the basis e, determines the relative risk over time for each individual or group:

$$h_0(t) = \lambda_0(t) e^{\beta_1 x_{i1} + \cdots + \beta_k x_{ik}}$$

or

$$\log h_i(t) = \log \lambda_0(t) + \beta_1 x_{i1} + \cdots + \beta_k x_{ik}$$

The baseline hazard is left unspecified but must be positive; for the control individual/group, it is obtained if all covariates are 0.

After the baseline hazard has been calculated for the individual or group 1, the same must be done for the individual(s) or group(s) that will be compared with this control group or reference. Then, to finally obtain this *hazard ratio(s)* relative to the base line hazard, the hazard rates of this individual 2 (or n) or group 2 (or n) must be divided by the baseline hazard of individual 1 or group 1.

$$\mathrm{HR}_1 = \frac{\mathrm{h}_0(\mathrm{t})}{\mathrm{h}_1(\mathrm{t})} = \frac{\lambda_0(\mathrm{t})\mathrm{e}^{\beta_1 \mathrm{x}_{\mathrm{i}1}+\cdots+\beta_\mathrm{k}\mathrm{x}_{\mathrm{ik}}}}{\lambda_0(\mathrm{t})\mathrm{e}^{\beta_1 \mathrm{x}_{\mathrm{j}1}+\cdots+\beta_\mathrm{k}\mathrm{x}_{\mathrm{jk}}}} = \mathrm{e}^{\beta_1(\mathrm{x}_{\mathrm{i}1}-\mathrm{x}_{\mathrm{j}1})+\cdots+\beta_\mathrm{k}(\mathrm{x}_{\mathrm{ik}}-\mathrm{x}_{\mathrm{jk}})}$$

This is a formal Cox Regression.

Unlike Kaplan-Meier, Cox Models are semi-parametric. Like non-parametric models, they include very few assumptions and don't require the choice of some particular probability distribution in advance. This allows for much more flexibility than parametric models. Still, Cox Models assume that the hazard functions for the individuals or groups under observation are *strictly parallel*. "If $h1(t)$ and $h0(t)$ are hazard functions from two separate distributions, we say that they are proportional if

$$h1(t) = \psi h0(t),$$

for all t ≥ 0, for some positive constant ψ and all t ≥ 0" (Broström 2012, p. 31). If this is true, then this holds true for the respective cumulative hazard functions $H_1(t)$ and $H_0(t)$

$$H_1(t) = \psi H_0(t), for\ all\ t \geq 0,$$

(ibid.). In this case, Cox Models are statistically more robust than non-parametric models. Furthermore, Cox Models produce covariate-adjusted hazard ratios, which is what we look for when trying to find out about effects of specific institutions on time(s) to event(s).

This leads to another characteristic of Cox Regressions: 'nested models'. Two models are called nested if one can be mathematically transformed into the other, by imposing constraints on the

parameters of the first model. Put more simply, the second model does not contain new information but simply 'drags' existing information out of the general reference model. The results of the nested model are thus first calculated for a stand-alone one and then divided by the reference model.

A Cox Regression applied to marriage and possible simultaneously-occurring events, such as the example of the death of the mother, bears the problem of competing risks. Competing risks might result in distorted p-values. These can be countered with a shared frailty model that includes a normally distributed random effect that measures possible heterogeneity between the individuals. The above model thus has to be extended by this effect:

$$h_{ij}(a,t) = h_0(a)e^{\beta X_{ij} + \gamma Z(t) + \omega Y_i},$$

whereas ωYi describes the vector of the estimated matrix Y for the random effect for each individual 1/ group 1 (Mills 2011, pp. 166-169).

For completeness, a final comment is needed here for a third 'model family', which is relevant to event-history and survival analyses, specifically on parametric models. Parametric models, unlike non-parametric and semi-parametric models, assume a pre-defined probability distribution. Examples are the Weibull, exponential, or log-normal distribution. If the assumptions made about the respective distribution are correct, parametric models tend to be more statistically robust than their counterparts and their results more precise. However, in 'real-life', with truncated data and several covariates, the exact distribution is usually unknown, and making assumptions could be dangerous. The decision to use Cox Regressions therefore remains for the analyses.

3.3.3 Parameter Estimation and Interpretation

The parameters of these Cox Regressions are obtained by maximising the partial log likelihood of the parameters. This works as follows:

$$\ell = \sum \mathrm{f} \log(e^{\beta' \mathrm{x_f}} \times \sum \mathrm{r(f)}\, e^{\beta' \mathrm{x_r}})$$

The first term´s summation is over all failures f, the second over all subjects r(f) who are still alive (but at risk) at the time of failure, the risk set. In other words, ℓ can be interpreted as the log profile

likelihood for β after eliminating $h_0(t)$. The maximum likelihood method selects thus the set of values of the model parameters that maximises the likelihood function. Rather than assuming maximum likelihoods, as parametric models do, Cox Models calculate the *partial likelihood* of subjects experiencing the event until they are censored. In other words: the maximum likelihood of the risk set (Kleinbaum and Klein 2012, pp. 112ff).

The result output in almost every statistical tool will display at least the following results (though the output design will differs): for explanatory variables, it will show the coefficients (coef) of all parameters which read as regression coefficients, their exponential coefficients exp(coef), which are the hazard ratio and what we are mostly looking for, their standard errors se(coef), their Chi Square statistics (Chisq), obtained by dividing the coefficients by their standard error, and their respective p(robability)-value (Pr(>|z|), or simply p-value), testing the 0-Hypothesis for each.

The results will also display their overall suitability. Next to the overall p-value for our nested models, this can be done via the Likelihood ratio test. This is essentially an extended Chi Square (χ^2)- test, extended in the sense that

$$H_0: \beta_{p+1} = \ldots = \beta_k = 0$$

can be tested as

$$\chi^2_{LR} = -2\left[\log\left(\hat{L}(1)\right) - \log(\hat{L}(2)\right]$$

Under H_0 this test statistic is approximately distributed as χ^2 with q degrees of freedom (df).

When going back to our example of the impact of the death of the mother on marriages from 1810-1999 in Würselen, the output from R is the following:

Results Table 1: Example

Call: coxph(formula = Surv(start, stop,event) ~ Moth_Dead + Price_Cycle_Wheat:Moth_Dead + frailty(id), data = MarriagesWürselen)

	coef	exp(coef)	se(coef)	Chisq	p-value	
Moth_Dead1	0.224	1.252	0.038	35.320	0.000	***
Moth_DeadNA	-0.041	0.960	0.034	1.500	0.220	
frailty(id)				0.240	0.370	
Moth_Dead1:Price_Cycle_Wheat	-0.192	0.825	0.225	0.730	0.090	.
Moth_DeadNA:Price_Cycle_Wheat	0.012	1.012	0.202	0.000	0.950	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**

Iterations: 5 outer, 26 Newton-Raphson

Variance of random effect= 5e-05 I-likelihood = -1000

Degrees of freedom for terms= 2.0 0.2 3.0

Concordance= 0.526 (se = 0.004)

Likelihood ratio test= 51.76 on 5.24 df, p=0.0000000086

Of our 200 individuals (n= 200), 150 would marry in the period observed (number of events = 150). Those whose mothers die (Moth_Dead1) have an increased likelihood of marriage (exp(coef) 1.252) when compared to their counter parts during years of economic ease, while this result would be statistically significant to a level of 99.9% (Pr(>|z|) 0.000). In years of economic stress (Moth_Dead1:Price_Cycle_Wheat), with a mother's death, the chances of marrying would decrease (exp(coef) 0.825) with a statistical significance to a level of 90% (Pr(>|z|) 0.090). The overall p-value (0.0000000086) shows that the entire model is statistically significant to a level of 99.9%. The overall 0 hypothesis can thus be rejected.

Interpretation without the historical context and description of the data is not recommended here. However, in a purely illustrative sense, it can be speculated that the death of a mother eases caretaking obligations on the ego and facilitating marriage during economically better years. Such caring obligations could point to strong family ties. During years of economic pressure, the death of the mother hinders marriage, pointing towards additional economic pressure resulting either from burial costs and/or the loss of income earned by the mother.

It is now necessary to move on to examine the data requirements, and to present the data that will be used for the study. The next subchapter also discusses the modelling strategy, and what will be measured later in the statistical models.

3.4 Data Description

The data description will begin with the data requirements, in order to provide an overview of the data necessities of this study. The data required to carry out this study can be put into three categories:

1) Additional Context Data: gathered to add information where knowledge of the historical context and prevailing institutions is missing in the available literature.
2) Economic Stress Data: time series data for approximating economic stress.
3) Longitudinal Individual Micro Data: data that allows for measuring the time it takes an individual to experience marriage.

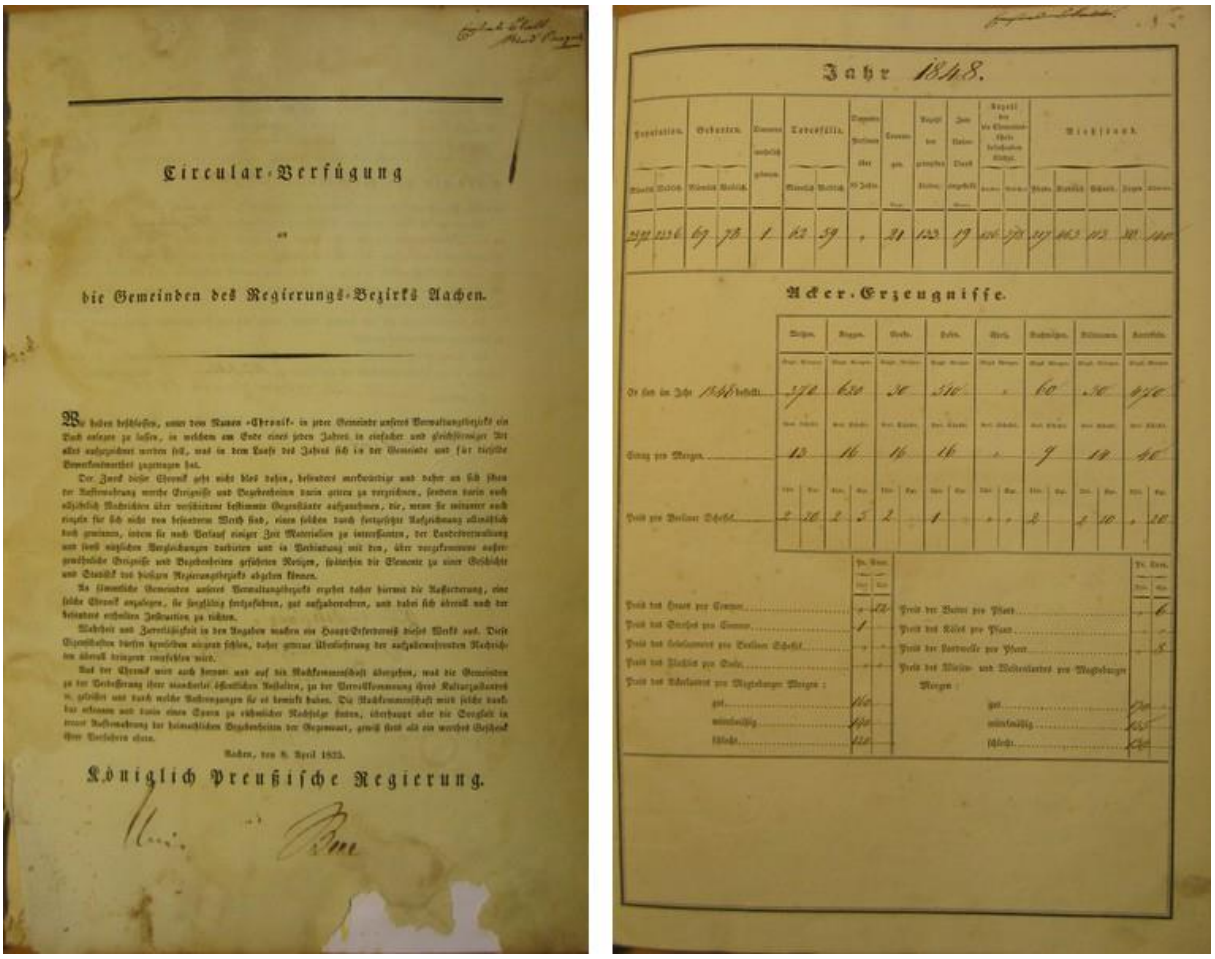
1) Additional Context Data: scattered (local) literature and archive data required for reconstructing historical realities and relevant stress-attenuating institutions.

   During the fieldwork trips, both literature and archive data could be gathered for reconstructing the broader historical context, the local histories of the communes, and respective economic stress-attenuating institutions. Next to standard literature about the general and the economic history of the region in question, local literature was found for all of the three communes under research. Books, contributions, studies from local tourist agencies and formal and informal talks to local representatives (in short, all relevant information) was gathered, evaluated and interpreted. Where there was insufficient information for reconstructing the historical context of a commune or specific institution, primary archive data was added:

   a) Würselen: Kulturarchiv Würselen

   The main additional primary sources for Würselen come from its Bürgermeisterchronik (The Mayor's Chronicles). The information obtained here was mainly used for reconstructing the historical context and constructing and comparing price series. The Mayor's Chronicles, established in 1824 by the local authorities and continued until 1868, was an administrative tool applied throughout the Prussian District of Aachen to gather local statistics each year about crop prices, amounts of sown and harvested crops, life stock prices and population, the latter including the number of marriages, births, deaths and inhabitants. It was carried out by the local mayor's office. The following picture shows an extract from 1848:

Picture 1: The Mayor's Chronicles of Würselen in 1848



Circular-Verfügung

an

die Gemeinden des Regierungs-Bezirks Aachen.

Königlich Preußische Regierung.

Jahr 1848.

Acker-Erzeugnisse.

Source: Kulturarchiv Würselen, author's own material

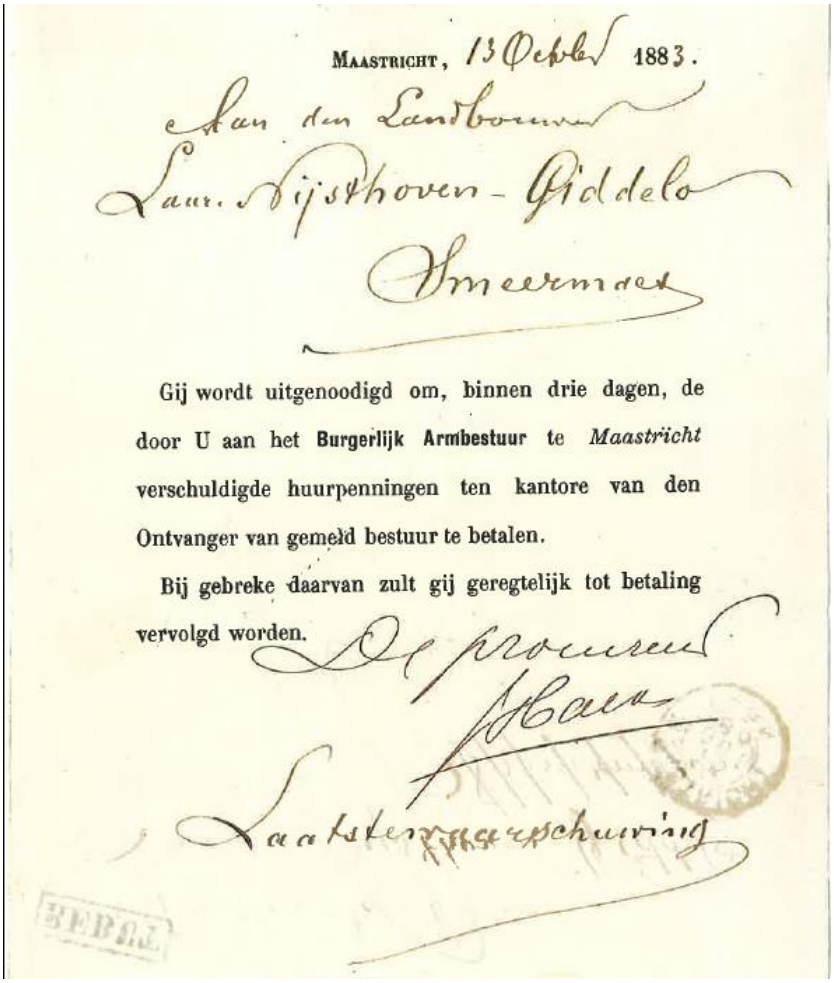
The fact that these chronicles were initiated and reported on by the local authorities points to both their interest in the data itself and their motivation for its precise gathering. Because of this, and the additional small scale and local character of the data, it can generally be considered to be of a very high quality.

b) Meerssen: Regionaal Historisch Centrum Limburg

The main additional sources for the Meerssen data were of a more qualitative type, and found in the Regionaal Historisch Centrum of Limburg. Several primary sources, such as certificates of indebtedness, mortgage certificates and poor relief notes, were gathered to establish a more complete picture of Meerssen in the 19th century. Picture 2 shows an example of a peasant in

1883, who has been called upon to pay back the money he had received from the poor relief office of Maastricht, the commune right next to Meerssen, within three days:

Picture 2: Certificate of Indebtedness, Maastricht 1883



MAASTRICHT, 13 Octobre 1883.

Gij wordt uitgenoodigd om, binnen drie dagen, de door U aan het **Burgerlijk Armbestuur** te *Maastricht* verschuldigde huurpenningen ten kantore van den Ontvanger van gemeld bestuur te betalen.

Bij gebreke daarvan zult gij geregtelijk tot betaling vervolgd worden.

Source: Regionaal Historisch Centrum Limburg, author's own material

Overall, Meerssen was clearly the best-studied commune of the three, and few additional sources were needed to satisfy the data requirements.

c) Sart: Archives de l'État à Liège

The picture is somewhat different for Sart. Although Sart has been extensively research in terms of economic stress and demography by the EAP (EAP all three volumes: 2004, 2010, 2014; also Neven 2002; Alter et al. 2004, 2007), including the description of several surrounding institutions, it was not possible to obtain suitably precise figures for all the

institutions relevant for this study. While it is well known on an aggregate level, poor relief in the commune of Sart itself remains unknown in scale. It was therefore necessary to gather and include primary archive data in the analysis for Sart. An example of a digitalised extract on poor relief data can be found here:

Table 1: Digitalised Accounts of the Poor Relief Office in the Commune of Sart

Year	Office costs	Poor relief in money	Poor doctors	Books for poor Children	School heating	…	Total sum of expenses	Total sum of Receipts	Yearly result
1828	1.41	170.01	4.6				707.14	899.01	191.87
1829	2.8	170	4	3			717.41	842.47	125.06
1830	1.41	170	4	3			694.98	770.56	75.58
1831	2.54	40	4	3	5		627.8	657.6	29.8
1832		142.36	4	3	5		666.69	684.63	17.94
1833		60	8.5				1279.72	1390.43	110.71
1834	2.6	100					1174.95	1497.55	322.6
1835	1.98	100			12		1342.25	1774.65	432.4
1836									0
1837									0
1838									0
1839									0
1840									0
1841									0
1842	3.08	150					2014.76	2089.69	74.93
1843									0
1844									0
1845									0
1846									0
1847	5.5	150	17				2339.47	2498.2	158.73
1848	5	160	8.5				1847.32	2052.12	204.8
1849	8.23	150					1525.67	1968.43	442.76
1850	8.4	150	20				1463.95	1645.75	181.8

Source: Belgian State´s Archive in Liège, poor office accounts, author's own material

This extract shows the yearly accounts of the poor relief office of Sart. They provide valuable, detailed information about the yearly change of expenses for poor relief and for different positions of its household (e.g. books for the poor, school heating and the total yearly expenses). T poor relief offices' income, are municipal funding, subsidies obtained from land tenures, and rents. The yearly results are the difference in these total yearly receipts and the total yearly expenses. These statistics are important for understanding the institution of public relief in Sart.

Similar time series could be constructed for the yearly number of short term prisoners and abandoned children – possible indicators of short-term economic stress, as will be explained in the next section.

The local authorities of Sart had to report to the next highest administrative level, which was the Department (Ourthe) or the Province of Liège. The latter had to report to the Belgian state. Though smaller mistakes can always occur within such a structure, this annual local and reported data can be considered generally to be of a high quality too.

The aim of reconstructing the historical context and the institutions relevant for this study is mainly achieved through the data described here. However, for the institutions where measurements are possible, and in order to be able to measure change (and, more specifically in the interest of this study, the reactions of individuals and couples to short-term economic stress over time), two more types of data are needed: data for depicting economic stress and longitudinal micro data for the individual or couple.

2) Economic Stress Data

As mentioned in 3.2, economic stress can be modelled through a time series of economic indicators (such as real wages, food prices, harvest amounts, climate data and criminal statistics). Whichever economic indicators are used must be consistent over time and assigned to fixed time intervals. For the Border Triangle, time series for yearly crop prices are available and usually of high quality (to be discussed in the next section for each commune). Crop prices are the standard for modelling demographic behaviour under (short-term) economic crises. A second reason to rely on the crop prices is that they also allow for comparability with the EAP. These prices will be taken for the closest city/location to the commune as "trans-regional

markets might not have followed the same dynamics as prices in local markets […]" (Willführ and Störmer 2016, pp. 181f, further discussed in Chapter IV). This allows for reconstructing economic up and downswings as exactly as possible for each of the local communities.

a) Würselen: food prices for several items (rye, wheat, oats, and barley) are available in The Mayor's Chronicles for 1824-1864. These prices will serve as a base that will be filled with the available prices from series of Cologne's market for rye and wheat. Thanks to the Deutsche Forschungsgesellschaft-Project: "Deutsche Agrarpreisstatistik" (Rahlf 1996)[26], these time series are available from 1816 until the end of the study period. Both the Würselen and the Cologne series measure yearly average values only. However, the seasonal price fluctuations found by Rahlf in his data are very limited, and often do not occur at all (Rahlf 1996, pp. 137ff). Cologne is about 75 km from Würselen, but the correlation between Cologne rye prices and the years of rye prices available for Aachen (1821 – 1865 with 14 missing values) indicate a very high correlation between the two growth rates for the entire period ($r = 0.88$, $n = 31$)[27]. This indicates very similar price developments between the two markets[28]. The yearly rye and wheat prices from Cologne therefore serve as a suitable gap filler for where Würselen's data is missing, as well as a time series to approximate local economic stress for Würselen.

b) Meerssen: the data here is provided by Tijms (Tijms 1983). In his study on Maastricht, Tijms is able to reconstruct time series of prices for different commodities from 1815 until the end of the study period. These series were reconstructed from shipping lists (effractielijsten) and market prices, and transformed into a series of yearly average values. Thanks to Tijms, consistent time series, the wheat, rye, oat and barley prices are available and can be used as

[26] https://histat.gesis.org.
[27] ibid.
[28] In his article on integration processes on the Westphalian agricultural market, Kopsidis (Kopsidis 1998) uses correlation and the coefficients of variations in harvests for approaching market integration processes. Rightly pointing towards the strengths and weaknesses of this method, he also affirms that it is feasible for distinguishing between market fragmentation and integration in regional studies (Kopsidis 1998, pp. 170f). Applicable for prices too, this method can be applied in the present study when further describing market integration and price fluctuations for the Border Triangle in Chapter 4.1. For international studies on historical prices and market integration, more advanced co-movement analysis techniques would be more advisable (see, for instance, Uebele 2009, 2010).

indicators for economic stress. Through the reconstruction of the local histories, the best indicator will be identified and then used in the statistical modelling.

c) Sart: the data here will be taken from EAP.[29] In addition to basket of goods indices, we can find time series for several foods, such as beef, butter, potatoes, wheat, rye, and oats, from 1811-1900. This data is already published and easily accessible. However, this data is mostly based on national food price statistics, and only partly based on local prices from the Verviers market. These prices depict a mean development of prices for the whole of Belgium, instead of the local developments that are needed. Economic stress can mean something very different for one commune or another, as discussed earlier. Therefore, it seems indispensable for this study to search for local proxies other than food prices that could indicate short-term economic stress.

   The state's archives store detailed annual data for detainees in the city of Verviers, locked into the so-called 'passage house' (*maison de passage*). These prisoners were kept for a maximum sentence of up to one month for committing small crimes, such as swearing in public, street fighting, and heavy or flamboyant alcohol consumption. The yearly number of detainees who committed small crimes might also be a valid proxy for economic stress, and this will be tested.

   The search for indicators revealed annual mortgage rates for the Belgian province of Louvain, which lies right next to the region under research. Of course, with mortgages being one of the possible stress-attenuating institutions, these rates too might have an impact on the demographic behaviour of couples, and will therefore also be tested for their suitability as indicators of short-term economic stress.

   A final reconstructed time series is one of the yearly numbers of abandoned children in Verviers. It is conceivable that desperate parents abandoned their children, and that the number of desperate parents grew during economically stressful years and, consequently, the number of abandoned children. This series, however, is quite incomplete, and does not promise too many results.

[29] Download here: http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/32461.

3) Longitudinal Individual Micro Data

The third type of data necessary for the analyses is longitudinal individual micro data, with which the demographic responses to economic stress can be observed. Such data records life-events of an individual at different points in time. A certain number of n individuals with longitudinal data compose a sample. A sample is needed to make a comparison possible and significant, and to be able to draw conclusions. The bulk of the data for the statistical analysis of the present study is composed by genealogical data. This type of data usually contains the type of information that is needed here, allowing for the reconstruction of individual life courses and for carrying out event history analyses. Genealogical data can therefore serve as a gap filler for when other historical demographic micro data is hard to reconstruct (Smith and Oeppen 1993). This being the case in the present study, let us begin the data presentation with an overview of the character of genealogical data, sources, and general problems.

Though there is also written source material available (which holds its own problems of bias towards richer or noble families), genealogists working in the 19th century within the Border Triangle would mainly rely on the following 4 sources:

1) civil registers
2) baptism, burial, and marriage registers
3) population registers
4) personal cards

(Post et al. 1997, p. 265, adapted)

Civil registration in the Border Triangle began at the start of the French occupation period, between 1792 and 1794. Before this, genealogical information can be found almost exclusively in parish registers. Population registers mainly came about after the 19th century, personal cards later in the 20th century. When following Post et al., the information obtained through these sources "might be considered good enough to allow the reconstruction of the whole family history" (ibid.), with increasing odds of finding information to do so "the more one approaches the 20th century" (ibid.).

From these sources, reconstructed genealogical data may still have several shortcomings: one problem that is inherent in genealogical data is the under-registration of individuals and events

(ibid). The representativity of the genealogical data sets has also been criticised (e.g. Dupâquier 1983). The presence of these problems and their magnitude are, however, highly dependent on the source material: the completeness of registered individuals in earlier sources is usually somewhat less certain than for later source material. Under-registration is more likely to occur in these earlier sources. Generally speaking, it can be said that information increases with time, leading to a bias towards a younger population in the early years of the 19th century, as some older kin might have been lost before (Post et al. 1997, p. 265). The under-registration of individuals also increases when the individuals were younger at death. The personal interests of the genealogist reconstructing a family line may not have led them to individuals that had no further impact on the development of the family. In other words, "those who belonged to early generations but died young were most likely to be excluded" (ibid). Another common and related problem with genealogical data is the under-registration of stillbirth, infant and child deaths (see Knodel 2002, p. 42 Appendix B for an extensive discussion). These three events (especially the first two) are of little genealogical relevance, and therefore can be lost. Consequentially, the level of reported stillbirths in genealogies is sometimes (perhaps often) below official statistics (e.g. Knodel 2002, p. 481). These official statistics already risk the under-registration of stillbirths, depending on counting methods or cultural conceptions of what a stillbirth actually means. However, under-registration of stillbirths, infant and child deaths hardly affects a study on marriage behaviour in the 19th century, as such a study is occupied with the event which comes before any birth: marriage. At the other end of life's timeline, a larger number of death dates is often missing in genealogical data, either due to the fact that some people are still alive or the limits given by respective privacy and data protection laws. The death registers for Germany, for instance, are accessible for research purposes until 1987, at least 30 years back in time. For the Netherlands, access to such data is restricted to 50 years after the death of a person. Belgian data has to be at least 100 years old to become accessible without institutional permission. Furthermore, due to the precondition of being related which is inherent to genealogical data gathering, it is possible and even likely that individuals without any relations will not appear in a given database. Even if that database opts for complete coverage of the inhabitants of a certain geographic area, it is the link to kin that makes them enter a genealogical tree. As a consequence, fertile and long-living families tend to be somewhat overrepresented (Störmer et al. 2018, p. 42), as it is much easier to trace them

and their family links back in time. Additionally, individuals and events like divorces, remarriage and migration are prone to omission and loss. In the 19th century, long-distance migration often caused family division both in the country of destination (Fertig 2000, p. 91) and origin, and could "mean that the family lost track of those who had left and could not obtain any information on their descendants" (Post et al. 1997, p. 264). Short-distance or short-term migration could distort the number of children of a family if that family emigrated, since migration itself is usually not reported on time in genealogical data. Some children, then, might have been born into a family after the migration occurred without being recorded. Migration might also influence the probability of detecting first marriages, the main event of interest in this study: "[r]ecently there has been considerable discussion of the possibility that the estimation of average age at marriage might be affected by migration" as "[l]ate marriages occur after the typical age for migration and therefore tend to be excluded from the analysis, reducing in turn the average age of marriage for the stayers when compared to the leavers" (Voland 2000, p. 136).

The representativity of genealogical data is often threatened by the small number of families reconstructed in the databases of their owners (Post et al. 1997, p. 264). When analysing genealogical data, statistical significance is usually obtained through a large sample size due to the above-mentioned difficulties and the arising 'noise' (Voland 2000, p. 139). Therefore, the larger the sample, the better for statistical analysis.

Another problem that affects the historian working with genealogical data is the fact that most genealogical reconstruction has no or little additional information about the historical circumstances the individuals lived in (Lee and Wang 2001, appendix), and often has no information on the location of the individual's life events. It is, therefore, always advisable to add either contextual information (as with this study), personal information (more suitable for larger studies) or both to the existing data.

Finally, it should be noted that, for most genealogists, genealogy is a hobby. Due to their different backgrounds, many have never been trained in using historical sources, and might be too uncritical with them. This could lead to the uncritical copying of imprecise information, such as age-rounding for events. This could lead to lower data quality.

With this in mind, the longitudinal data of both 1) the Familienbuch Euregio and 2) the EAP/ Sart data can now be discussed in detail.

1) Familienbuch Euregio

Despite the numerous potential shortcomings and problems with genealogical data, it is both the design of this study and the knowledge and sincerity of genealogists that has created the genealogical database in use for this study. It strongly diminishes these general threats: the present study focuses on marriages as the main means for carrying out a preventive demographic behaviour, making many of the above-mentioned dangers of under-registration (such as that of stillbirths or infant/child mortality) negligible. Additionally, events such as divorces or remarriage are not important for the questions asked here. As will be explained in the next section, the sheer size of the database and constant quality checks diminish a large amount of the potential flaws. The reconstruction of the local histories in Chapter IV and additional information on the occupations of individuals tackle the issue of there being a lack of insights into the daily lives of the individuals in the database. The study proposed here allows a researcher who is aware of these problems to use and analyse the given genealogical data to draw reasonable conclusions.

The Familienbuch Euregio will provide the data for the communes of Würselen and Meerssen. Under the supervision of Iris Gedig (owner since 2007) and the technical supervision of Peter Bücken, the team around the Familienbuch Euregio consists of about 10 hobby-genealogists, who have now been extending this database for more than ten years. The Familienbuch Euregio is a privately-owned genealogical database, covering the year 1500 up to today. Its database contains information on over 500,000 individuals, distributed in the following regions (only for those that have information on their place of birth):

Table 2: Distribution of Individual Genealogical Data per Birth Place in the Familienbuch Euregio

Number of individuals	Share of total	Region
140777	34 %	County of Aachen, Germany
50956	12 %	Province of Limburg, The Netherlands
40302	10 %	City of Aachen, Germany
27472	7 %	County of Düren, Germany
13701	3 %	City of Mönchengladbach, Germany
12435	3 %	County of Neuss, Germany
10986	3 %	County of Rhein-Hunsrück, Germany
10935	3 %	County of Heinsberg, Germany
10481	3 %	Province of Liège, Belgium
55000	22 %	Other Regions

Source: Familienbuch Euregio web-page, "Überblick zum Datenbestand des Familienbuchs Euregio", valuation date: 28.02.2018.

Amongst the 140,777 individuals born and registered in the County of Aachen, around 38,000 have Würselen as a birthplace. While consistent data for Würselen is available from around 1650 onwards, it is for the 19th century that life events are most completely entered into the database, when taking Table 41 in the appendix into account. The data collection period for this study ended on 28.02.2018. The main task for the owners of the database is the reconstitution of families in the Euregio region. In order to do so, the team gathers all available information that helps in reconstructing the life courses of individuals as completely as possible, and adds this to the families that have been reconstructed.

Structure and examples: the data is stored within two MySQL databases, one for individuals and one for the indexed and reconstructed couples. Table 3 provides a raw example from the data base.

Table 3: Extract of the Individuals Data Base from the Familienbuch Euregio

id	gen	fid	mid	ord	Prename	Name	prof	born	dead	Bornloc	deadloc	text
1332237	1	0	0	0	NN	NN	rk	1735-09-25	1801-09-02	Morsbach / Würselen	Morsbach / Würselen	Beruf: Arbeiter (Ouvrier 1801), Kupferschläger [Evers] ...
1117438	2	0	0	0	NN	NN	rk	1733-02-22	1817-01-05	Morsbach / Würselen	Morsbach / Würselen	[Evers] ...
1369403	1	1332237	1117438	1	NN	NN	rk	1761-06-05	1818-11-27	Morsbach / Würselen	Morsbach / Würselen	Beruf: Arbeiter (Ouvrier 1801), Kupferschläger, Messingarbeiter [Evers] ...
1609256	1	1332237	1117438	4	NN	NN	rk	1767-02-15	1839-01-31	Morsbach / Würselen	Verlautenheide / Aachen	Beruf: Kupferschläger (1817) [Evers] ...
1328152	1	1332237	1117438	8	NN	NN	rk	1775-01-17	1837-07-18	Morsbach / Würselen	Drisch / Würselen	Beruf: Kupferarbeiter (cupri opifex 1815), Ackerer (1831) [Evers] ...
1871247	2	0	0	0	NN	NN	rk	1761-07-27	1796-12-28	Morsbach / Würselen	Morsbach / Würselen	[Evers] ...
1323653	1	1369403	1871247	3	NN	NN	rk	1793-04-15	1866-04-05	Morsbach / Würselen	Elchenrath / Würselen	Beruf: Kupferschläger (1824, 1832), Messingarbeiter (1830), Kupferer (1834) [Evers] ...
1262892	2	1193758	1165869	5	NN	NN	rk	1768-04-04	1849-05-13	Morsbach / Würselen	Morsbach / Würselen	Maria Josepha Storm [Evers] ...
1573432	2	1369403	1262892	3	NN	NN	rk	1802-05-09	1874-03-30	Morsbach / Würselen	Morsbach / Würselen	[Evers] ...

Source: Familienbuch Euregio

The information on individuals provided by this database is rich: typical information for individuals is sex (gen), related ancestors (parents, fid, mid), name (prename, name), birthdate (born), deathdate (dead), birthplace (Bornloc), deathplace (deadloc) confession (prof), occupation (text, sometimes without, sometimes several) and additional information (text), such as a source of origin for the information.

Children are linked to their parents via their father or mother's ID, which is assigned in the above MySQL database for each individual. Married couples are thus found by a father ID (fid) and a mother ID (mid). These two IDs are linked via one specific couple's id (id) in the couple data base (shown below).

Table 4: Extract from the Familienbuch Euregio Couples Database

id	hid	Wid	ordh	ordw	date1	date2	loc1	loc2	text
1332237	1369403	1871247	0	0	1787-08-26		Würselen		[Heiratsbuch] ...
1117438	1369403	1262892	2	1	1797-02-27		Morsbach / Würselen		[Heiratsbuch] ...
1369403	1930623	1470871	1	1	1890-02-13		Würselen		[Heiratsbuch] ...
1328152	1557345	1743403	1	1	1898-09-09	1898-09-10	Alsdorf	Würselen	Die Familie wohnte …
1593259	1063308	1616919	2	1	1878-09-28		Aachen		[Heiratsurkunde] ...
1174274	1056374	1437286	1	1	1864-04-06	1864-04-07	Würselen	Würselen	[Heiratsurkunde] ...
1717707	1609256	1854341	1	1	1795-10-10		Verlauten-heide / Aachen		[Heiratsbuch] ...
1242868	1063308	1508515	1	1	1865-05-05	1865-05-06	Würselen	Würselen	[Heiratsurkunde] ...
1844196	1946264	1893044	1	1	1821-07-27	1821-07-27	Würselen	Würselen	[BrauersH] ...

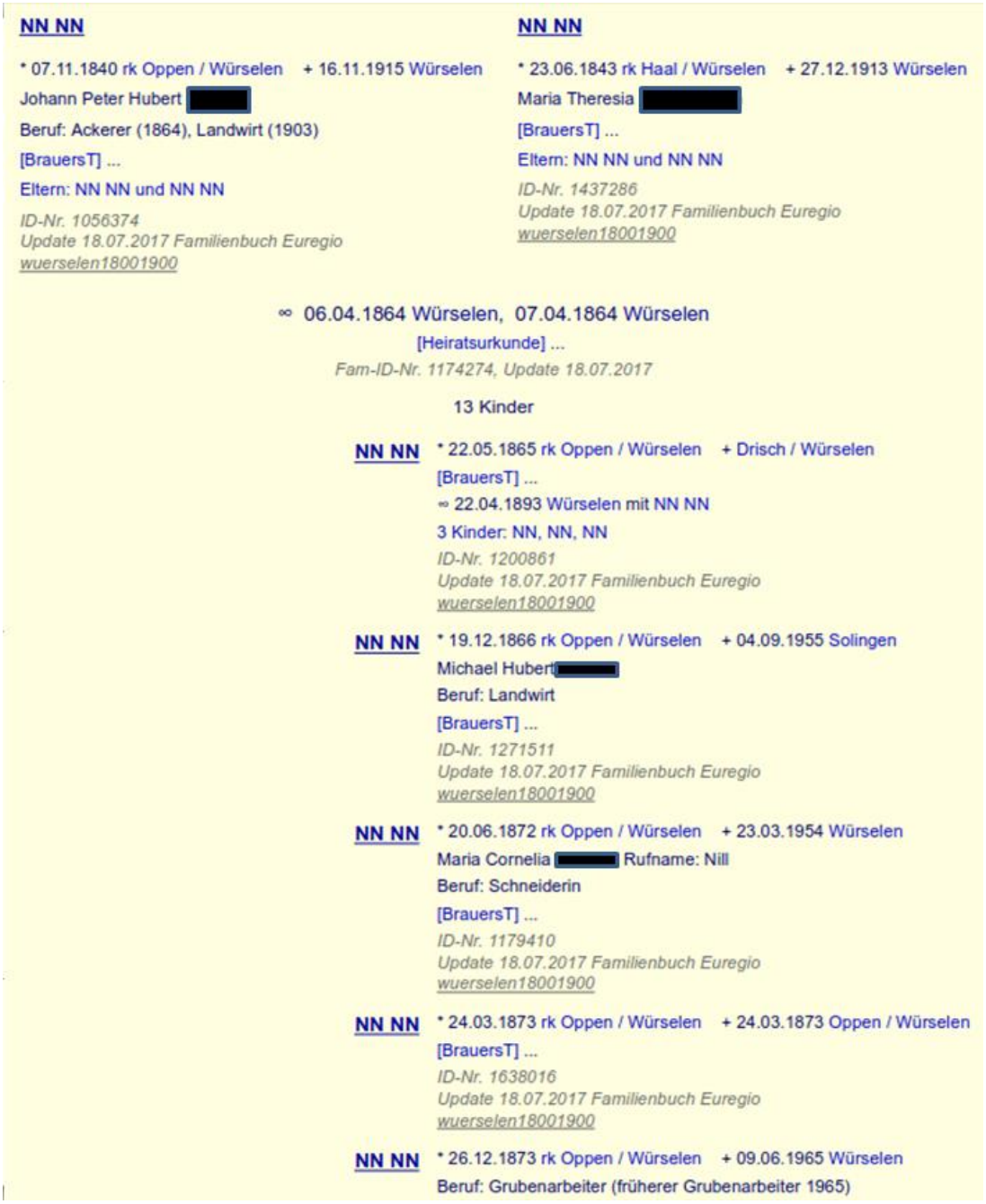
Source: Familienbuch Euregio

Mainly extracted from marriage books/marriage certificates, there is a couple id (id), the id of the husband and of the wife (hid, wid) and often complete information on the numbering of the marriage (the first, the second, the nth marriage for the husband or wife) (ordh, ordw), the

marriage date (date1, date2), the location where the marriage took place (loc1, loc2) and additional information, such as the source of origin for the information (text).

With this structure, it is possible to provide additional information on the marriage date, the marriage partner, the place of marriage and parents for each individual via the linking of hid with fid for fathers and wid and mid for mothers. An anonymised example (extract) of this structure after family tree reconstruction is provided in the following picture:

Picture 3: Familienbuch Euregio Family Reconstruction Example



NN NN

* 07.11.1840 rk Oppen / Würselen + 16.11.1915 Würselen
Johann Peter Hubert [redacted]
Beruf: Ackerer (1864), Landwirt (1903)
[BrauersT] ...
Eltern: NN NN und NN NN
ID-Nr. 1056374
Update 18.07.2017 Familienbuch Euregio
wuerselen18001900

NN NN

* 23.06.1843 rk Haal / Würselen + 27.12.1913 Würselen
Maria Theresia [redacted]
[BrauersT] ...
Eltern: NN NN und NN NN
ID-Nr. 1437286
Update 18.07.2017 Familienbuch Euregio
wuerselen18001900

∞ 06.04.1864 Würselen, 07.04.1864 Würselen
[Heiratsurkunde] ...
Fam-ID-Nr. 1174274, Update 18.07.2017

13 Kinder

NN NN * 22.05.1865 rk Oppen / Würselen + Drisch / Würselen
[BrauersT] ...
∞ 22.04.1893 Würselen mit NN NN
3 Kinder: NN, NN, NN
ID-Nr. 1200861
Update 18.07.2017 Familienbuch Euregio
wuerselen18001900

NN NN * 19.12.1866 rk Oppen / Würselen + 04.09.1955 Solingen
Michael Hubert [redacted]
Beruf: Landwirt
[BrauersT] ...
ID-Nr. 1271511
Update 18.07.2017 Familienbuch Euregio
wuerselen18001900

NN NN * 20.06.1872 rk Oppen / Würselen + 23.03.1954 Würselen
Maria Cornelia [redacted] Rufname: Nill
Beruf: Schneiderin
[BrauersT] ...
ID-Nr. 1179410
Update 18.07.2017 Familienbuch Euregio
wuerselen18001900

NN NN * 24.03.1873 rk Oppen / Würselen + 24.03.1873 Oppen / Würselen
[BrauersT] ...
ID-Nr. 1638016
Update 18.07.2017 Familienbuch Euregio
wuerselen18001900

NN NN * 26.12.1873 rk Oppen / Würselen + 09.06.1965 Würselen
Beruf: Grubenarbeiter (früherer Grubenarbeiter 1965)

Source: Familienbuch Euregio

Picture 3 shows how families are reconstructed in the Familienbuch Euregio. Since information is given on the characteristics and vital events of individuals over time, this data allows for event-history analyses in the manner of this study.

The Familienbuch Euregio is not professionally run. Therefore, not all of the above mentioned potential flaws can be eliminated. The procedure for collecting data, for instance, does not follow any fixed rules. Rather, the genealogists pursue their interests and follow information and links dependent on their availability. One might call the data-collection process a "snowball system" that started in Würselen but extended throughout the Euregio Region Rhine-Maas. Still, according to the owners, their aim is to gather data for individuals from and in Würselen as completely as possible for the 19th century, an aim which they have largely achieved, as proven by the following statistics: of all the baptisms registered in the Church Books in Würselen from 1645-1809, 16,025 of 19,014 (84%) are recorded in the Familienbuch Euregio (see Table 41).[30] From 1801 to 1900, these numbers are 19,570 of 20,330 (that is 96%; ibid.). When assuming that the French population counts are exact, 98% of the individuals living in Würselen in 1801 are covered in the data base.[31] Despite these efforts, under-registration of certain individuals without further specified family ties remains, as these individuals are not part of any family reconstitution and therefore not taken into account. Such individuals will not appear in any family indexing. However, while this might cause greater problems in overseas studies, the number of individuals without any family members in the area covered by the Familienbuch Euregio is likely very limited.

Some marriage, birth, and death data still lacks entries, mainly for the end of the 19th century, though these are only problems for the descriptive statistics part. With the researcher aware of this issue, this problem is very manageable, as time to event-analyses are able to deal with this type of censored data, as described in 3.3.

The main sources used by the developers are secondary sources: historical individual records from online available databases, mainly from wiewaswie.nl or other genealogical ones. According to Iris Gedig, they compose about 2/3 of the data. The remaining 1/3 of the data is compiled through primary sources: parish registers on marriage, births and deaths, baptism records and all other available sources (other family books, newspaper articles, graves-stones, secondary sources to ease the linking process, etc.) which either contain information for reconstructing families or enable the developers to check existing information.

[30] The reference figures for the entire village come from The Mayor's Chronicles of Würselen, from the yearly accounts of 'important events' in the village.

[31] See the French Population Counts of 1801 here: http://www.familienbuch-euregio.de/genius/php/ewoList.php.

The amount of information given in the database further reduces what has been identified above as possible additional flaws of genealogical data: the data of the Euregio Familienbuch often provides additional information on historical circumstances, such as the location of events like marriages, or occupations. From the latter, it is possible to reconstruct the prevailing ecotypes and, with this, the prevailing economic sectors in each commune over time.

Migration can be traced to some extent. If an individual migrated between the known life-events birth, marriage, and death, and if there is information on the place of these events, migration is reconstructable, though without specific timing. For instance, the owners' own statistical analyses for 68,571 couples with at least one spouse born in the region show that the average distance of the birthplace of their first child to that of theirs increases over time,[32] pointing towards an increasingly geographically-mobile society. As mentioned earlier, and typically for genealogical data, it is only migration that causes the loss of the information on life events needed here. Additionally, and more importantly for this study, specific times are necessary for analysing migration as an outcome of event-history analyses. Migration will therefore not be analysed through statistical modelling, but contextually.

The composition of sources is slightly different for Meerssen. While Würselen consists of a mix of primary and secondary sources, the data from Meerssen in the Familienbuch Euregio data base is almost exclusively taken from individual files from WieWasWie (wiewaswie.nl; CBG|Centrum voor familiegeschiedenis 2018), a major database for individual Dutch historical records. WieWasWie contains millions of historical documents about individuals, coming from primary sources such as birth certificates, population and baptism registers, wedding and funeral records, and more.[33]

For Meerssen, the Regionaal Historisch Centrum Limburg provides additional data on three life events (marriages, births, and deaths) for individuals who experienced one of these events in Meerssen from 1797 to the end of the period under investigation. This additional data has been put into the existing database, and now complements the formerly scarce data for

[32] http://www.familienbuch-euregio.de/genius/php/ewoPage.php?tam=Kahlen&sub=PublicAll&page=1236&tree=0:1:2:3:4&showTable=1&all=0.

[33] For more information on sources and a discussion of their quality, see https://www.wiewaswie.nl/en/sources/.

Meerssen (see Table 41 for the ratios of available and digitalised data). In order to professionalise (academically) and create greater attractiveness for an international audience, entering this data into the Familienbuch Euregio is in the interests of its board. It has therefore been done by its staff up to the end of this project's data gathering phase. During the final analysis, the data contains 7,195 cases with birthplaces in the commune of Meerssen (validation date 28.02.2018) for the 19th century.

Leaving aside these shortcomings, as far as the quality of the data is concerned, generally speaking, both the primary data and that stored in the database of the Familienbuch Euregio are of very high quality and are highly reliable. Few mistakes between this data and complementary sources were found, according to the owners, and only a few inconsistencies for data entry. Those which were found were, however, immediately corrected through comparison. As there were many checks and double-checks carried out at fixed time intervals, the overall quality data of the final database itself can be considered excellent. Updates too are made whenever possible.

Before now turning to the description of the data used for the third commune under research (Sart), it is important to point to the differences in the data provided by the Familienbuch Euregio and the EAP data for Sart. Differences are found in both sources and, consequentially, data composition. Other than the Sart data, the Euregio Familienbuch provides neither information on migration when it actually happened nor on household composition, as there are no household lists used and no information given on co-residences, for instance. Again, the design of this study helps to mitigate these differences. Migration can and will be discussed and reconstructed as a common phenomenon in Chapter IV. While it remains desirable, it will not be necessary to include it in the statistical analysis. Marriage partner reconstitution is possible without information on cohabitation. Comparability, therefore, remains assured.

2) The EAP/Sart data

The population registers of Sart, Belgium for 1811-1900 are very modern, in the sense that they fulfil most of the desired criteria by current standards: according to the definition of the United Nations, population registers are “an individualized data system, that is, a mechanism of continuous recording, and/or of coordinated linkage, of selected information pertaining to

each member of the resident population of a country in such a way to provide the possibility of determining up-to-date information concerning the size and characteristics of that population at selected time intervals" (United Nations 1969, chapter I, A). Population registers are thus "the product of a continuous process, in which notifications of certain events, which may have been recorded originally in different administrative systems, are automatically linked to it on a current basis" (United Nations 2017). The most basic information on such registers consists of variables such as name, sex, birthdate, date of death, birthplace, place of death, citizenship and marital status. More complete registers may also contain information on migration. For using such registers for (vital) statistical analyses, linking events to the population at risk is necessary (ibid.).

The population registers of Sart are sufficient for this analysis: originally produced in 1997 in Liège, Belgium and Bloomington, USA, the data was officially published under the supervision of principal investigators Michel Oris, George Alter, and Muriel Neven in 2011 (Oris et al. 2011). The files describe the characteristics and vital events of individuals from a sample of municipalities in eastern Belgium on an individual and a household level from 1806 to 1900. Around 2000 couples and 53,000 events were recorded. Particular attention was given to sources with a longitudinal dimension, showing not a static cross-section but a span of time, creating the dynamic of life course transitions. The population registers recorded births, marriages and deaths, and also contain information on migration and household composition. The population registers were based on censuses and/or nominative lists created in 1811, 1843, 1846, 1856, 1866, 1880 and 1890. With this data, it was possible to continuously update the overall data. Information from a census was copied into registers, which were then updated when the population changed at the next census. These censuses often included information about de facto residents, such as servants. It is therefore possible to construct complete biographies of the individuals who lived in 19th century Sart (ibid.). Additional information was added about births, marriages, and deaths from civil registers.[34]

One problem with the Sart data is the under-registration of migration. People often neglected to report that they were migrating to the municipality, even though it was required by law. Short-term migrants (like domestic servants) are also under-reported. Another problem is the

[34] Original description shortened and adapted for own purposes.

under-registration of marriages. If someone left Sart to marry elsewhere, the marriage was not always reported. Therefore, there is likely some under-counting of marriages held outside of Sart in which the groom left Sart at the time of the marriage (ibid.)[35]. However, as with the data for Würselen and Meerssen, this problem is exclusively one for the descriptive statistics part of the analysis, as event-history analysis can easily deal with censoring. However, the reduction in the amount of analysable events may create some problems when it comes to statistical significance for the results.

A final comment is necessary regarding the comparability of the data gathered in total: as indicated in the introduction, in historical data analyses the available data and its quality is usually distributed asymmetrically between two entities. Even within the EAP, and even though the data here was rich and of an overall sound quality, the researchers had to deal with this problem (see e.g. data on economic stress, Bengtsson et al. 2004, p. 464). As mentioned before, this does not impede comparison if the researcher is aware of the problem, discusses it critically, and approaches it with care during the interpretation of the results.
With this methodology and the data description, let us now move on to the sampling and modelling strategy for the analysis.

3.5 Sampling and Modelling Strategy

Because of their similar data structure and comparable problems, Fertig and Fertig's approach to sampling data in their article on "Deliberation, Bodies, and Desire […]" in northwest Germany will be followed (Fertig and Fertig 2017) for the analysis of the preventive demographic behaviour in Würselen and Meerssen. The genealogical data discussed in 3.4 was transformed into a longitudinal dataset that allows for event history analysis. The dataset was restricted to individuals who were likely to marry in either Würselen or Meerssen. More specific, it covers the time men and women were likely to marry in either Würselen or Meerssen, the unit of observation being a period of time, a 'spell' (Alter and Gutmann 1999), for a given individual. The main interest of this study is not an analysis of marriage behaviour as such, but an analysis of marriage being the

[35] Original description shortened and adapted for own purposes.

starting point of reproductive behaviour. Starting reproductive behaviour before marriage was uncommon in the 19th century (Schlumbohm 1997, p. 99), and would have already occurred before a second marriage. Only first marriages were therefore included in the sample. As seen above, this is also commonly done in the literature (Chapter 2.1).

Life course studies typically compare the effects of processes that occurred over the course of life, such as ageing, marriage duration, and births and deaths of relatives. They usually have problems with multicollinearity if the sample is not large enough. Studies in economic history, however, are often based on smaller datasets, making it difficult to clearly isolate effects. Following Goldberger, from a statistical perspective, multicollinearity and micronumerosity are the same problem (Goldberger 2003, Chapter 23). As life course studies and studies in economic history both have these specific technical problems, exact replication is not a suitable guideline for the present study. Instead, a slightly adapted analysis will be used. The sample choice is also determined by both the state of the art procedure in the literature and the technical necessities given by the study. For Würselen and Meerssen, this is as follows:

1) In order to be included in this study, individuals must have a birth date and either a marriage date and a testified marriage place in one of the parishes of Würselen/ Meersen, or a death date and either a birthplace or a place of death in Würselen/ Meerssen. This allows for as many individuals as possible that have some ties to the two respective communes. However, it leaves some (constructive) vagueness as to what concerns migration, and will probably create some bias: those who marry and then migrate are included in the sample, those who migrate and then marry (or not) are not included. Logically, an overrepresentation of those who marry when younger is created (Ruggles 1992, pp. 508ff, 514).

   If a marriage date is missing, the assumption is that the individual did not get married. This assumption is problematic, as missing information is treated as actual information. The amount of individuals who appear as never married in the sample will thus be higher than the true number. It is nevertheless fair to make this assumption, as nested Cox Regressions are estimated in relation to each other, and therefore the overall results for time of marriage are altered only a little by this. This problem is more concerning for the descriptive statistics part.

A missing death date makes the situation more complicated. For marriage, the observation ends and the death date plays no further role. With a missing marriage date, the correct censoring set to 49.9999 years of age and a missing death date, we cannot simply assume both that the individual did never marry and did not die before 50. These individuals cannot therefore be included in the sample (cf. Ruggles 1992, pp. 511f), as this would leave too much vagueness when correctly interpreting the final results.

2) Each observation is identified by an identifier for the individual, by the point in time in numeric representation (e.g. 1. January 1810 is represented as 1810.0), by the type of event that happened at this point in time, and by the time and type of the event (e.g. marriage or a change in grain prices).
3) Several static variables can be attributed to each individual under observation. These are assigned when their observation period starts: at 16 years of age for women, 18 for men (occupation and gender are discussed below).
4) Other variables change over time for each individual (the number of older siblings and price fluctuations are discussed below). These changes are accounted for and noted according to the beginning of the time period they occur in.
5) The event of interest here is marriage, and the unit under observation is the time an individual 'survives' until they experience this event. In order to be able to determine the start date for an observation, each individual has to have a birth date available. Individuals that have missing values here are not taken into account. In addition to the removal of date before age 16/18, the final observations of an individual are either marriage, death, or a 'survival time' to not marry of 49.9999 years, censored afterwards. As is common in the literature, these latter survival times/ages are deliberately chosen to start and end the observation for every individual under research, in order to minimise both mistakes and the results biasing outliers too strongly.[36]

[36] Note that survival times are sometimes restricted to 45 years (e.g. Dribe et al. 2014). However, in order to prevent the loss of a certain (though small) percentage of cases, it was also decided to take the 45–50 age group into account. This seems to be the overall trend in general demography studies. The .9999 is a construction that will help to reduce the cases that pile up through rounding, and which might distort the overall picture.

The sampling for Sart differs somewhat from the previous two. Though the idea was to use the same sampling method as previously described in order to guarantee the highest level of comparability, this was not possible, as there is no information on marriage location in the Sart data. Instead, the artificial assumption was made that everybody who was born in Sart, who has a marriage date and no recorded migration event, also married in Sart. This assumption ensures that there is a high probability of a marriage which occurred in Sart.

Modelling Strategy & Variables

For the statistical modelling of marriage reactions to economic stress, it is best to again refer to the starting point of this study and to apply the EAP-researcher-established strategies to the research question of this study. Of course, the main idea here is placing economic stress and demographic responses together. The measurement of living standards through event history analysis remains the focus. However, the modelling strategy must serve the analytical framework established in 2.2, under which this study is carried out. More precisely, the model should allow at least some additional evidence to be obtained for possible related impact on marriage behaviour for each of the institutions reconstructed above (see again Figure 6). Thus, instead of simply replicating the studies of the EAP researchers on marriages, some other variables will come into focus. The models will include the following constructed variables, with the following expected impact on demographic behaviour:

i. Economic stress:

   Economic stress will be modelled through the promising time series that will be identified in Chapter IV. They will each be tested, while only one or two with the most impact will be used for modelling, in order to stick to the strategy of conceptualising the most parsimonious models. The time series are typically lagged for a year (EAP, Fertig and Fertig 2017; Bengtsson and Dribe 2006), depending on the interest and design of the study, in order to model possible demographic reactions to changes in settings that had actually already taken place. The series will be filtered using a Hodrick-Prescott Filter, with lambda (λ) = 6.25 as suggested by Ravn and Uhlig (Ravn and Uhlig 2002) and common in the literature for annual price data (e.g. Quaranta 2013), in order to remove its overall trend.

   The main expectation here was formulated as Hypothesis I in 2.1 and further described in 3.2: that couples would wait out years of economic stress and delay marriage until years of

economic ease. Additional interaction effects of economic stress with institutions possibly relevant to economic stress in the three communes will give more detailed information on the impact of these institutions (further discussed in 4.2).

All the other constructed variables will represent or help to approximate the relevant remaining institutions as far as possible (see Table 30, developed in Chapter IV). Their technical construction, interpretable content, and expected impact on the timing of marriage will now be described:

ii. First_Born_Male is a dummy variable that assigns a 1 to all males who were the first-born in their family, and a 0 if this statement is false. This variable allows us to draw further conclusions about inheritance practices and hierarchy, as seen in 2.2. It thus represents a share of the informal institutions of family organisation and family ties, here related to inheritance practices. It is also possible to construct an additional NA variable, and an additional variable for first born females, in order to further disentangle effects. However, the NA cases are expected to be few, especially in the genealogical data (with its primary goal of reconstructing families), and the theory has not revealed any suggestion that first born females have advantages in marriage. The calculation trials may include such variables, but it is unlikely that they will appear in the final results.

The EAP researchers in the 2014 volume discuss this variable in the context of other siblings and competition for resources. In the Swedish study of this volume, Dribe and Lundh find hardly any effects of the higher parities on marriage (Dribe and Lundh 2014, pp. 244f). Derosas et al. point in the direction of lower chances for marriage for the higher parities (Derosas et al. 2014, p. 337). Dillon finds a "systematic advantage" for first borns through more "substantial opportunities" (Dillon 2010, p. 172). Bras and Kok do not find the first born males (or females) to habe advantages for marrying in their case study on sibling differences in marriage timing from the northwestern Netherlands (Bras and Kok 2016, p. 200). The expectations of the effects of this variable are therefore difficult to predict: event history analysis measures both timing and the likelihood of an event occurring. This is difficult to disentangle for the effects of being a first born male, as the heir could be expected to be more likely to marry, but later, as he would have to wait for his inheritance. A comparison of the three communes in this respect will bring more clarity, should their inheritance systems differ.

iii. Gen is the gender variable that assigns a 0 to all males and a 1 to all females in the sample. It measures the distribution differences between men and women, and their overall chances on the marriage market (Dribe and Lundh 2014, p. 240).

Throughout the literature, women marry earlier than men. It is also usually expected that a larger share of men increases the chances of women marrying, and vice versa (ibid.), the latter only being the case when men marry before women.

iv. Fath_Dead and Moth_Dead show if the father or mother of an individual is alive or dead at the beginning of each time interval (the time intervals typically being a year, as prices change every year). Fath_Dead and Moth_Dead are thus time varying variables in the following way: Fath_Dead answers the question "is the father still alive at the beginning of each new interval?" Here, the variable retains a 0 in the data frame, whereas if the father has died at the beginning of a specific time interval, a 1 is assigned. The same is true for Moth_Dead.

The death of a father is often analysed in the context of the death of the male breadwinner and of the endogenous economic stress which occurs within the family, and the impact of this on child mortality (see the many related articles in Derosas and Oris 2002). The mother's death is also strongly associated with an increased risk of child mortality (ibid.). When following Bras and Kok's studies for the Kennemerland (NL) and Voland and Willführ's case studies for the Krummhörn region (Ger), it is the death of the father that has a strong "positive" effect on earlier marriage. While Bras and Kok allude to the niche principle for an explanation of this phenomenon, Voland and Willführ reason that earlier marriage, and the generational transfer that comes with it, serves as a compensation for the loss of the largest income provider (Voland and Willführ 2017, p. 134). Though not discussed by the authors in either of the two articles, the death of the mother has similar effects in their studies, indicating that she also would have made important contributions to the family income. The (perceived) obligation of children to take care of their parents in old age (cf. Bouman et al. 2012, pp. 21f) is also only lightly discussed. Though this obligation could be expected to be quite weakly developed in Western societies, a certain amount of children would still look after their parents when help is needed in old age (Dillon 2010, p. 174). Following any of these explanations for the potential facilitation of

marriage after the death of a parent, there is no reason not to expect similar results for this study.

v. n_Older_Siblings is the variable that counts living older siblings at the beginning of each time interval with the same logic as iv. The response variable, then, is an increase or decrease of the time of marriage for the younger sibling. It was possible to split the number of older siblings from 0 to 3+ (the last group containing either 3 or more older siblings).
In the literature, the number of siblings is often discussed in the light of resource dilution (Bras et al. 2010; Kok et al. 2011; Öberg 2017). Resource dilution describes "the fact that the limited resources available to the parents – e.g. money, food, time, energy, patience – are shared across all children in the household. If there are many children there will be fewer resources available per child" (Öberg 2017, p. 157). The results of the European studies of the EAP 2014 volume support this view (Dribe and Lundh 2014, Oris et al. 2014, Derosas et al. 2014, though the latter study is for Italy and without statistical significance). The number of children as an input variable is usually measured in childhood in such studies, the outcome variable health, status, or living standards of the ego in their later life. Again, an exception is the Bras and Kok study on sibling differences in marriage timing, where the input variables are explicitly constructed as time-varying. The authors find that being a child somewhere in the middle parities proves to be most advantageous for early marriage (Bras and Kok 2016, p. 200). The number of older siblings measured in the present study, unlike in the above-mentioned studies, constitutes an input variable at a stage of life at which they already had the chance to build up their own lives through marriage and funds, and where resource dilution is no longer a threat. Thus, despite the "often ambivalent relationships between siblings, which tend to be characterized by simultaneous cooperation and competition" (Voland and Willführ 2017, p. 134), these older siblings can now be expected to be helpful (Bras and Neven op. 2007, p. 213). Neither Voland and Willführ nor the (European) EAP case studies find results that support this expectation during economically normal years. The mid-parity advantages found by Bras and Kok could indicate such effects: during years of economic stress, older siblings could be expected to be at least a potential informal economic stress-attenuating institution for their younger siblings, depending on the strength of their family ties. It should therefore be expected that during years of crisis, if there is the real need for help, older siblings will

have a positive impact on the chances of marrying if family ties are strong. Cultural norms also play a role in determining a sibling's chance of and timing for marriage. In some parts of the Netherlands, Belgium (van de Putte, Matthijs and Vlietinck 2008, pp. 37-72; Carmanne 2005, p. 25) and Germany (especially in Westphalia) (Fertig 2003b, p. 10f), the cultural norm of the youngest sons and daughters being expected to assist the parents in old age could be seen in the 19th century. Taking care of parents in old age may lead to the delaying or even foregoing of marriage. Other cultural norms demand girls marry by birth order. It is possible to detect and discuss such effects in models without interaction with economic stress. The more older siblings an individual has, the lower their marriage chances are in these cases. When dealing with economic stress and interactions with economic stress variables, however, these effects should automatically be checked, as they do not change when economic stress occurs. In other words, economic stress should have no influence on the advantages or disadvantages of an individual in marriage over their siblings, with respect to cultural norms.

vi. Hisclass_5 represents the social strata variable according to international standards (van Leeuwen and Maas 2011, see 4.2.4). It is divided into six categories (including "NA") that each represent one social layer of society (excluding "NA"): "Elite", "Lower Middle Class", "Farmers", "Self-employed, Skilled Workers", and "Unskilled Workers". This variable makes it possible to further deconstruct and to be more explicit about the vulnerability of individuals under economic pressure, according to their social status.

The results of the EAP marriage studies are somewhat ambiguous: for Sweden, there are only a few significant results (Dribe and Lundh 2014, p. 240, table 7.7). If at all, it is the landless population that delays marriage to some extent. In Sart, farmers tend to marry earlier than all the other social strata, with statistically significant results mostly when compared to the lowest strata (Oris et al. 2014, pp. 278f). In the Italian parishes, the "better off displayed a risk of marriage lower than that of the poorest group" (Derosas et al. 2014, p. 331), findings that are supported by Bras and Kok in terms of marriage rates (Bras and Kok 2016, p. 202).

The expected results are dependent on the ecotypes of each commune. However, during years of economic stress, it must be expected that the poorer strata of society will generally suffer more, need longer to recover, and therefore delay marriage most visibly. Where

farmers have enough land to sustain themselves or even sell grain during crisis years, they can be expected to marry earlier than their peers during years of economic stress. For Sart, it makes sense to expect similar results to those of Oris, Alter, and Servais (Oris et al. 2014), as indicated above.

vii. There are two more context variables included in the model according to their appearance in time: a Savings_Banks_in_Use variable that divides a certain period into a pre-savings bank and a savings bank in use period, and a Small_credits_avail variable, that does the same for the availability of small credits. These variables are self-explanatorily prone to critique, as possible effects and explanations remain highly speculative. These two variables basically serve as the completeness of the model, and as a starting point for further discussion and research.

viii. With all these variables, additional interaction effects with the respective economic stress variable are simulated to estimate their effect on marriage behaviour.

ix. For all the variables, it was important to keep the "NA" values in the sample in order to maintain a sufficiently large number of cases. Without including these, robust results would have been unobtainable for all of the models.

x. For each of the three communes, the models themselves were further divided into periods, with regard to levels of industrialisation (further elaborated upon in Chapter IV) and feasabilityoperationability: 1810 – 1839, 1840 – 1869, 1870 – 1899, for Würselen; 1810 – 1869, 1870 – 1899 for Meerssen; 1810 – 1859, 1860 – 1899 for Sart. The period division makes it possible to allocate certain effects or non-effects of the timing and stage of development for both formal institutions and industrialisation, always according to the reconstruction of the historical context and institutions developed in 4.1 and 4.2. The division into three separate communes allows for more detailed results and comparison.

IV The Border Triangle: Belgium, The Netherlands, and Germany

The Border Triangle of Belgium, The Netherlands, and Germany is located in Northwestern Europe. Map 3 shows the three respective states, part of a highly industrialised region.

Map 3: Border Triangle: Belgium, The Netherlands, and Germany – Overview

Today, this region is one of the European 'Euroregions', a political construction that usually refers to a multi-national, cooperative, territorial and socially cohesively structured entity.[37] These regions are supposed to strengthen inner European ties inter-regionally. The Meuse–Rhine Euroregion (Euregio Maas–Rhein in German, Eurorégion Meuse–Rhine in French, Euregio Maas–Rijn in Dutch), or the Border Triangle, was created in 1976 and formed one of the first Euroregions. Comparing and analysing the political, economic and demographic history of this small but heterogenous piece of European land is a challenging but auspicious task for the historian, as the analysis of the continuity and change of both the region and the specific communes is required. All this, however, promises a changing environment and observable transitions over time. Turning to and searching for individual data, while keeping in mind that a high level of comparability is a prerequisite, the Border Triangle is unique in terms of the amount of economic and demographic data available. As previously indicated, I have identified one commune in each of the three countries which form this border region (with the closest industrial centre in brackets):

- Würselen (Aachen, Germany)
- Meerssen (Maastricht, Netherlands)
- Sart (Verviers/ Liège, Belgium)

It is reasonable, in the present study, to always refer to and analyse the entire communes (other than when stated) instead of just the core villages. This increases the number of observable events somewhat, while still warranting institutional homogeneity within each commune. Map 4 zooms in on Map 3 to show the three communes:

[37] https://www.coe.int/en/web/good-governance/.

Map 4: Border Triangle: Belgium, The Netherlands, and Germany – Detail

The reasons for choosing these three communes are clear: geography places each of them right next to the national border of its 'home' country. All three are less than 50km away from each other making the surface area under research (ca. 600km²) smaller than that of Berlin (ca. 900km²) or Hamburg (750km²). All the communes have one industrial centre less than 12 kilometres away:

Würselen–Aachen (~ 6.5km); Meerssen–Maastricht (~ 6.7 km); Sart–Verviers (~ 11.5 km). This is important, because it ensures that the nearby commune will also be affected by industrialisation. At the beginning of the 19th century, these industrial centres would have been quite equal in size, helping to make the differences in trajectories more visible.

Of course, being 11.5 km from a centre (Sart - Verviers) is different to 6.5 km (Würselen – Aachen). We might therefore expect to see differences in some of the demographic behaviour related to industrialisation in Sart. While a worker living in Meerssen might walk every day to their job in Maastricht, taking about 1 to 1.5 hours walking along the rails,[38] a worker from Sart would need about double the time, somewhere between 2.5 and 3 hours one way, meaning about 5 to 6 hours spent commuting every day.[39] While this seems possible, and was not unusual for the 19th century,[40] it would probably have dramatically affected the decision to migrate to Verviers, or the slightly closer. These geographical differences and their implications will be taken into account in the results section.

4.1 The Border Triangle in the 19th Century

This reconstruction starts with the large development-lines of the long 19th century. This will help to judge the degree of transformation which people had to deal with at that time. Understanding these overall historical developments will also help to better reconstruct the local historical contexts and the formal and informal institutions in place, facilitating comprehension of the reasons for their development.

The 19th century was a period of dramatic change in Europe. Her pre-industrial or proto-industrial societies were at first only slowly affected by the emerging industrialisation. With time, more and more layers of society were affected until industrialising countries became industrialised. This is especially true for the Border Triangle of Belgium, The Netherlands, and Germany. Before moving to the history of the region, however, a suitable periodisation is needed to help articulate the different phases of larger changes for the region. Of course, every periodisation is prone to critique, as every researcher has a different focus for the research. As the focus of this overview section is

[38] This evidence was gathered in an experiment from the 9th of November, 2016.
[39] According to Google Maps.
[40] Personal talk with Prof Knotter, Dr Rutten, and Dr Gales (Knotter et al. 2016).

on the great changes in the Border Triangle, it makes sense to follow the main political events of the time. Using Wehler's magnum opus “Deutsche Gesellschaftsgeschichte” (Wehler 1995) as a guide (see also Tilly 1980, p. 28), the periodisation for the Border Triangle begins with the French occupation and proto-industrialisation period (1794 – 1815), followed by the ‘Vormärz' period and early industrialisation (1815 – 1848/ 49), and ending with the revolutionary aftermath, industrial take-off and phase of great industrialisation (1850 – 1900/ 1914).

4.1.1 1794 – 1815 French Occupation and Proto-industrialisation

Just before the French Revolution, the region was territorially and administratively embedded in the Holy Roman Empire, and was all but a unified territory. In 1789, the Austrian Netherlands, the Dutch Republic, Prussia, the Free Imperial City of Aachen, and the Prince-Bishopric of Liège all had territorial and administrative stakes and shares in this small piece of land. In this period, the territory might best be described as a region of scattered regionalism (ger. Kleinstaaterei) (Hardach 1996, pp. 10f). However, the region was strongly interwoven by trade and economic co-operation in the 18th century (Ebeling and Schmidt 1997, pp. 322-325).

Liège and Aachen had a significant hard coal mining sector in this period. The first industrial stream engine for mining was used in Liège in 1720. Mining around Aachen and Eschweiler involved numerous small businesses, applying simpler techniques. In the northern border valleys of the Ardennes and the Eifel, the iron industry was significantly developed. This proto-iron industry continued south, into the Duchy of Luxembourg in the Austrian Netherlands. However, the textile industry was the most important during this period. Vervier and Aachen (and parts of Limburg) were specialised in textile manufacturing. Production was clearly divided between spinning and weaving in the home, and dying and finalising production in factories. Other important industrial sectors in the region were metal-working in Liège, Aachen and their rural surroundings, the zinc and brass industry of Stolberg, and the leather, glasswork, ceramic and paper industries of Malmedy (Hardach 1996, pp. 9f).

In 1789, the French Revolution broke out in Paris, leading to the Revolutionary wars. Despite struggles in France, the French armies managed to occupy the Border Triangle in 1794, ushering in a period of greater cohesion for the region. The region belonged to Revolutionary France (and later to the First French Empire). From then on, the Border Triangle was politically divided into three departments (the administrative sub-entities of the French Empire, see Map 5): the Roer

Department (with Aachen the capital), the Meuse-Inférieure Department (with Maastricht the capital), and the Ourthe Department (with Liège the capital).

Map 5: The Border Triangle During the French Period: Administrative Subdivisions

The main legal institution of the period was the Napoleonic Code. It standardised the law, granted strong individual property rights, strongly diminished the power of the Church through the establishment of laicity in governments, abolished most of the guilds and their power, and stabilised land allotment by ending the manorial system. The French also reorganised commercial life through the introduction of the Code de Commerce, the opening of the French market (abolition of customs barriers and introduction of a single currency), and the protectionism from the regions to the east of the Rhine. With this, the seeds for both future cohesion and industrial growth were sown.

In 2016, Kopsidis and Bromley (Kopsidis and Bromley 2016) reignited the old debate of how influential these French policies really were by critically reassessing Acemoglu et al.'s article on the impact of "radical reform" in Germany (Acemoglu et al. 2009). Kopsidis and Bromley correctly attack the dating of several reforms used for measuring in the article. They also criticise the delay of the positive, measurable impact of the reforms (a delay of about 50 years) found by Acemoglu et al., and find that too little of the German population were actually affected long enough to be considerably influenced by the new French rules. In their view, black coal (and not the French reforms) was the main driver of industrialisation in Germany. While certainly having a point, the problem remains that the implementation of the French policies coincided with eastern Belgium's early transition towards fabric production and entrepreneurial activity. This makes at least some of Acemoglu et al.'s claims valid, if not for Germany as a whole, at least for the Border Triangle.

The implications of these policies, together with access to the French market, became visible in eastern Belgium first, where the transition towards fabric-production came soon after the French occupation. Together with Liège Verviers experienced this transition in 1800. With the appearance in Verviers of Willam Cockerill (an Englishman from Lancashire) and new technologies like the flying shuttle of 1802 and the carding machine from 1806, the 'golden age' of Verviers (french: "age d´or") set in (Desama 2013, p. 7).

Mining was also given attention during the French Period, including the creation of a mining law in 1810. In 1803, eight industrial shafts were in operation in the eastern mining region of Belgium, three of them operated by the state. They provided employment to about 1,500 people (Jappe Alberts 1974, p. 143). Through a strong Belgian influence, these first signs of industrialisation become visible in Aachen too. Inventors like Kuetgens, Dubusc, and Cockrill, who arrived in

Aachen during this period (Schainberg 2004[1997], pp. 279ff), would later shape and transform the region in the coming years. For Maastricht and surroundings, the situation was a little different: Maastricht's economy also profited from the Napoleonic cohesion policies, but with a different economic structure to the other two cities. During the French occupation, the economy of the Maastricht area mostly grew through grain, beer, gin, and sugar production: thus in agriculture and consumption, not industrial mass production (Jansen 1986, p. 532).

Population growth was particularly small for the two Limburgs: less than 1% per year from 1795 to 1815. The measures the French administration took to increase food production cannot be attributed to an attempt to relieve the population from resource constraints, but rather to support the constantly feeding of large armies in the region. Rye and potato production increased during the French period. The first was made possible through increasing the amount of land cultivated with rye, the second through a shift from potatoes being used mostly for animal feed to nutrition for the population (Jappe Alberts 1974, p. 141).

The new measures, combined with French Revolutionary ideology, had positive social implications:

> it can be said that the French government initiated far-reaching social reform. A rational government organization, a strong increase in legal certainty and the removal of restrictive economic measures have undoubtedly helped our region to participate in modern social development (Jappe Alberts 1974, p. 121, own translation)

and negative ones,

> on the other hand, social tensions grew. An increasingly large part of the population were improvised, with the situation made worse by the loss of various forms of social control of the "Ancien Régime" (ibid, own translation).

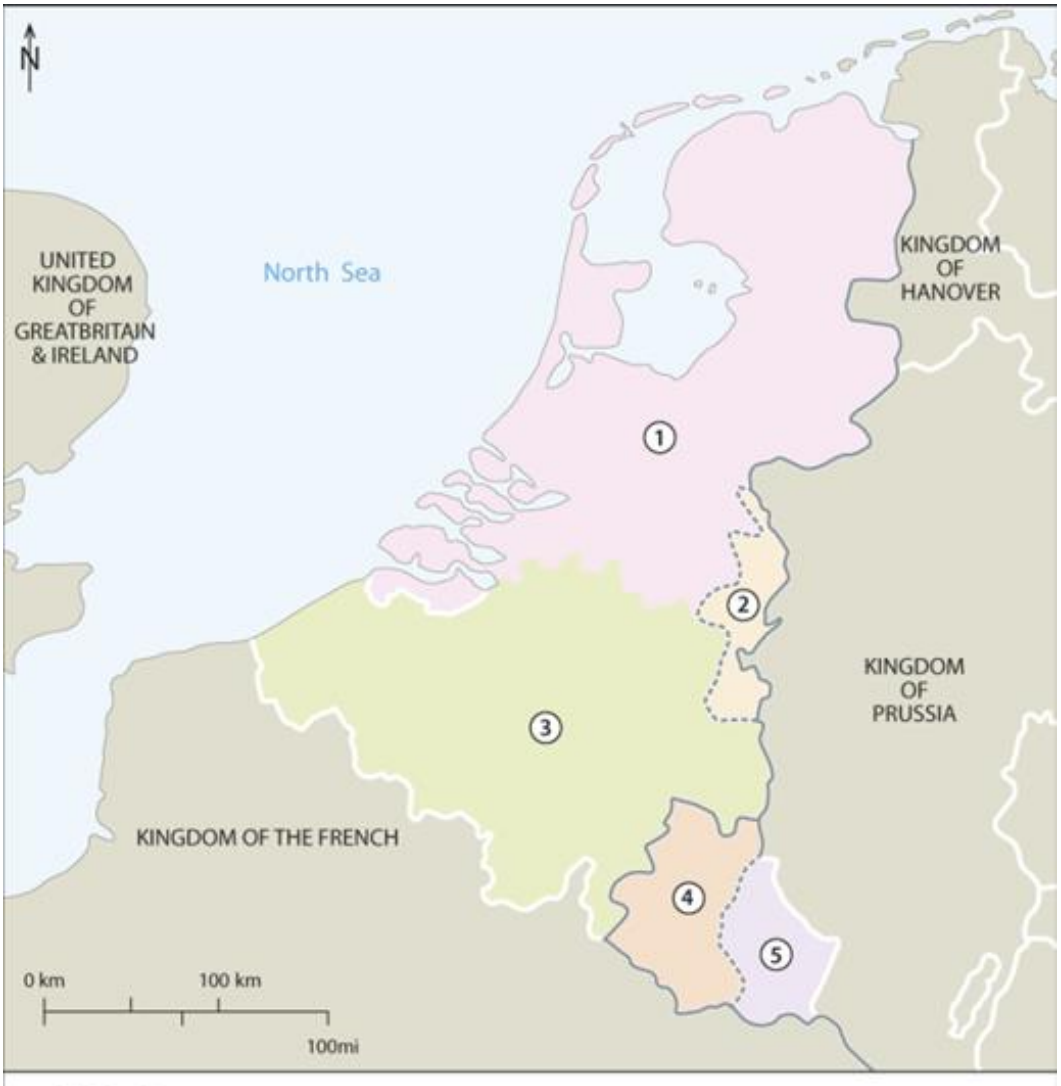
Along with a loss in social control, special taxes for the war (mainly in the first years of the French period) gave rise to further difficulties. Peasants were forced to sell larger shares of their harvests than before, and along with the reduction of investment opportunities (a result of changes in land ownership) and the abolition of monasteries, chapters, and other church institutions (which had previously provided credits, or "grondcrediten"), the growth of the production (Jappe Alberts 1974, p. 139) needed to sufficiently feed both civilians and soldiers was inhibited. Together with an unfavourable climate, this contributed to the crisis of 1816 which resulted in a winter of hunger.

The period from 1794-1815 undoubtedly set the frame under which industrialisation could break through. The political measures of the French, geopolitics, personal mutual interactions, forced secularisation, the construction of a relatively strong central government for the region, the omission of restitution of church belongings, and the re-orientation of the University of Liège towards liberal thought had all created an environment for entrepreneurship and early industrialisation (Jappe Alberts 1974, p. 160).

4.1.2 1815 – 1848/49 Pre-March and early Industrialisation

Napoléon's defeat changed the scene again. The years from 1815-1830 (the Restoration Period) were years of disintegration: the Congress of Vienna ascribed the former Department of the Roer (Aachen) to the Prussian state, and the provinces of Limburg (Maastricht) and Liège (Liège/ Verviers) to the United Kingdom of the Netherlands. Furthermore, with Maastricht remaining Dutch through the course of the Belgian Revolution, in 1831, Belgium separated from the United Kingdom of the Netherlands. With this, disintegration gained momentum. The internationally recognised Belgian independence of 1839 left the region separated into a territory with three national borders, resulting in the reintroduction of tolls and different currencies. This formal division of the region by modern state borders is illustrated in Map 6:

Map 6: The Netherlands, Belgium, Luxembourg and Limburg in the 19th Century



① ② ③ United Kingdom of the Netherlands (until 1830)

① ② Kingdom of the Netherlands (after 1830)

② Duchy of Limburg (1839-1867, in the German Confederacy after 1839 as compensation for Waals-Luxembourg)

③ ④ Kingdom of Belgium (after 1830)

④ ⑤ Grand Duchy of Luxembourg (borders until 1830)

④ Province of Luxembourg (Waals-Luxembourg, to Belgium in 1839)

⑤ Grand Duchy of Luxembourg (German Luxembourg, borders after 1839)

German Confederacy border 1815-1866; after 1839

Cartography: Jutta Turner
Base maps: https://qph.ec.quoracdn.net/main-qimg-3167bd8fe4a47a23b53da191fcf25fee, accessed April 4, 2018; Känsterle, 2005

Additionally, all three centres lost direct access to the French market. Economically worse for the region though was the fact that Napoléon's defeat resulted in the end of his Continental System, which prevented cheap English goods penetrating European markets. This led to a temporary but noticeable economic decline in the region. However, interregional trade never fully disappeared. New markets were found in the national states of each centre and linked to each other through international trade agreements. Prussia's trade agreements, first with the United Kingdom of the Netherlands and then with Belgium, incorporated low-toll or even toll-free trade, as well as free shipment and transit rights (Reckendrees 2010, p. 52). In addition to this, Zuidwillemsvaart channel trading was further promoted by the construction of streets to Maastricht (1817), Aachen (1825), and Verviers (1829), where renewed growth in textile production was made possible through the use of steam engines (Jappe Alberts 1974, p. 180). The industrialisation of Aachen and Maastricht can be partly explained through opportunity-seeking across the border. This led to entrepreneurs from the industrial centres around Liège investing in Maastricht and Aachen (Knotter 2002).

However, trade agreements and the opportunities over the border could only attenuate the upcoming hard years a little. The economic situation for people in the region became worse in all three centres despite overall industrial growth. Mass unemployment grew to unknown extents and poverty became a political problem. In late August 1830, riots spread from Brussels to Liège, Verviers, other eastern Belgian cities, and Aachen (Volkmann 1972, p. 553). With Maastricht being a garrison town, it was spared revolutionary riots but was blockaded from 1830-1833/1839 (Ubachs and Evers 2005, p. 63) by Belgian troops during the Belgian Revolution.

Despite these political troubles, industrialisation gained pace. Between 1815 and 1830, the first coke blast furnaces and factories applying the new puddle technology were introduced (following the British model) in the Dutch and Prussian parts of the region. In 1817, the iron factories of John Cockerill and his youngest son William established the nucleus of an enterprise of European importance in Seraing, near Liège. The region around Aachen became one of Germany's leading industrial centres (Hardach 1996, p. 22).

The development of the transport system, first through streets and canals and then through railways (Ebeling 1996, pp. 72, 86f; Fremdling 1996, p. 54), pointed to rapid change in the region.

Verviers experienced a phase of pronounced industrial growth from around 1815 to 1860. In 1816 the first steam engine came into action, and in 1838 there were already 75 of them. These surely

had their share in the production growth of about 9% that took place from 1839 to 1849. Officials counted 1,200 steam engines in action in 1850, and production increased by 6.5% in the following decade (Desama 2013, p. 7). According to the calculations of Desama, about 4,500 workers were employed in the textile factories of Verviers in 1848, and industrialisation also spread into its close surroundings (ibid.).

In the first half of the 19th century, Verviers experienced huge population growth. In 1806 it had around 10,500 inhabitants, which grew to about 23,000 in 1846, and to 40,000 in 1860: a growth of almost 400% in 55 years, or a yearly growth rate of 7% for 55 years in row. City growth from 1800 to 1850 was a result of 30% natural growth and 70% migratory influx, which mainly came from Verviers' surroundings (up to 20km in range), with a rising number of commuters whenever a new railway station was established (Desama 2013, p. 3). The reopening of the French market to Belgian products in 1842 and the agreements with the German Zollverein of 1843, together with a train connection running between Antwerp, Verviers and Germany, created and reinforced the environment needed for an industrial breakthrough (ibid.).

From early on, the district of Aachen profited from its Belgian neighbour, both in technology and capital transfer.[41] Coal production[42] in the district of Aachen (presented in Table 5) illustrates the acceleration of industrial activities in this transition phase:

Table 5: Coal Mining in the Districts of Aachen and Prussia 1820 – 1850 in 1000t

Year	District Aachen	Yearly growth in %	Prussia	Yearly growth in %
1820	143	-	1021	-
1830	179	2.5	1441	4.1
1840	273	5.3	2551	7.7
1850	359	3.2	4153	6.2

Source: Zapp 1995, p. 280

Clearly, the Vormärz period was one of industrial growth for the district of Aachen, as well as for Prussia as a whole. As one of the leading regions for industrialisation in Prussia, the district

[41] For more details on Belgian influence on industrialisation in the district of Aachen, see Schainberg 2004 [1997].

[42] Coal and steel production exemplifies industrial development. For similar growth patterns in the district of Aachen for 'neighbouring' industries, see Bruckner 1967.

contributed to over 10% of coal production of Prussia for almost the entire Vormärz and early industrialisation periods. Steel production and a growing industrial workforce were just two more indicators of early industrialisation in and around Aachen:

Table 6: Steel Production and Steel Workers in the City of Aachen and Surroundings, 1822 – 1857

Year	in cwt	Yearly growth in %	Workers	Yearly growth in %
1822	42744	-	111	-
1827	51392	4.0	318	37.3
1832	41293	-3.9	-	-
1838	87013	18.5	315	-0.1*
1842	139525	15.1	757	35.1
1846	1069391	166.6	2147	45.9
1851	395462	-12.6	2537	3.6
1857	1328428	39.3	4287	11.5

Source: Schainberg 2004[1997], pp. 68f. *1827-1838

Developments here are comparable to those in coal production. With the exception of the early 1850s (in the aftermath of the revolution), rapid growth is seen in steel production and workers over the period. As with Verviers, the demand for labour grew in this period.
In 35 years, the district of Aachen grew from 310,619 inhabitants in 1817 to 420,436 in 1852 (Zapp 1995, pp. 68f), an increase of 35.4%.

Table 7: Population of the District of Aachen, Aachen City and Surroundings, 1817 – 1852

Year	District of Aachen	Yearly growth in %	Aachen City & Surroundings	Yearly growth in %
1817	310619	-	43349	-
1828	348629	1.1	50682	1.5
1831	354629	0.6	51091	0.3
1837	369103	0.7	54064	1.0
1843	394451	1.1	58885	1.5
1852	420436	0.7	67478	1.6

Source: Zapp 1995, pp. 68f

While growth from 1817 to 1828 for both the district and the city of Aachen in Table 7 might still be explained though the aftermath of the Napoleonic wars, population growth had been apparent since the 1830s, fitting well into the developments just described.

The story of southern Dutch Limburg during this period is quite different. Though Limburg itself remained mostly non-industrialised until the end of the 19th century, the city of Maastricht was able to use its special position at the outskirts of the Dutch Republic to its advantage. The loss of the common French market and the geographical renewals of the Congress of Vienna were most severely felt here. Exports in agriculture and consumption goods went down between 25% and 50% (Jansen 1986, p. 532). This, of course, affected employment: one example is the decline of work in sugar production, where from 1816 to 1829 the number of workers went from 375 to just 10 (ibid.). From 1830 to 1839, Maastricht was under constant siege. However, and though one would expect increasing hardship, it is in this period that the city set the seeds for its industrial breakthrough: because of Maastricht's unwillingness to become Belgian, though originally situated inside Belgian Limburg, the Belgian government declared it part of a foreign country. Maastricht thus became a toll-free zone, and with this came production cost-reduction, modernisation, and Maastricht's Willam Cockerill: Petrus Regout. Regout started his industrial activities by opening up a nailery in 1834. By 1841, 340 people worked at Regout's factories alone (Jansen 1986, pp. 535f).

Maastricht, a fortified garrison city, housed 3,250 soldiers in 1816 and about 2,300 in 1830. According to Jansen (Jansen 1986, p. 533), this fostered retail trade and crafts. Either as a consequence of this or not, Maastricht grew from about 18,700 inhabitants in 1818 to 20,000 in

1823, and to 22,000 in 1830 (without troops). This was a yearly growth of about 1.47%. In 1839, 23,500 – 24,000 people lived in Maastricht (Jansen 1986, pp. 534ff), a growth of 20%.

In general, however, this early industrialisation period in the Border Triangle was marked by an industrialisation too new to allow the population to benefit from its growth. The years before 1848/49 were characterised by concomitants typical for early phases of industrialisation, such as child labour, social hardship, and the further impoverishment of formerly competitive small-scale handicrafts. Epidemics of air-borne diseases and pre-industrial crises were still constant threats, and in 1846, a Europe-wide harvest failure led to the last hunger crisis of the pre-industrial type. Poverty was a severe issue in the region: one in three inhabitants of Maastricht was poor in 1818, one in five in Liège (Jansen 1986, p. 541). By around 1850, up to 50% of the inhabitants of Maastricht were sporadically counted as needy (with some possible overestimation due to double counting) (ibid.). The situation was similar in Aachen and its surroundings, and the Belgian Revolution was the last spark the inhabitants needed to revolt in 1830. At the same time, the share of well-off people in Maastricht grew from 5 – 9 % from 1815 to 1855 (ibid.), indicating that wealth was created and grew in this early industrialising phase but that it was not equally distributed among the different layers of society.

With increasing nationalism, industrial growth and urbanisation further accelerating, the region entered its third phase in the 1850s: industrial take-off and great industrialisation.

4.1.3 1850 – 1900/1914: The Revolutionary Aftermath, Industrial Take-off and Great Industrialisation Phases

The last steps to political disentanglement of the remaining political cohesion of the region were initiated by the formal exit of Limburg from the German Confederation, and the 1815 defence alliance between Limburg and the German states was dissolved in 1866. The establishment of the North German Confederation in 1866 (which succeeded the German Confederation, the foundation of the German Empire in 1871 and the North German Confederation), were the last in a row of such acts. The three different state authorities, with their centres (Brussels, the Hague/Amsterdam, Berlin) geographically and culturally far from the Border Triangle, imposed their institutions on the region – the institutions, of course, which would best serve the interests of the state authorities. Though concentration on home markets intensified, economic cohesion remained quite stable during this period. Infrastructure played a crucial role here, as infrastructure development became

both an `industrial revolutioniser´ and a prerequisite for the upcoming industrialisation breakthroughs of the region. The Liège-Maastricht Channel was completed in 1850, road development was boosted and trains connected the three cities: in 1841, there was a train connection between Aachen and Cologne, and in 1853 Maastricht was connected to this line. In 1856 a connection to Hasselt was added, and in 1861 the connection to Liège was established. Southern Limburg was also connected directly with Antwerp port. In 1865, the Maastricht – Venlo connection was inaugurated, finally ending the isolation of Southern Limburg in the north (Oberndorff and Niesten 1994, pp. 205f). Despite political disintegration, the political actors in Brussels, the Hague/Amsterdam and Berlin were aware of the benefits of international cooperation for the economy and pushed economic coalescence through building connected infrastructure.

With the breakup of the German Confederation, the Duchy of Limburg left the Confederacy and remained an entirely Dutch province. The region around Maastricht remained a rather rural one at the beginning of the second half of the century (Pasleau 2002). However, Maastricht itself experienced an industrialisation comparable to Aachen and Liège/Verviers: during the 1840s, Petrus Regout extended his industrial empire further into Maastricht (and partly Meerssen), together with a growing number of other entrepreneurs. The big leap in terms of industrialisation was seen in the 1850s, when the number of industrial workers increased from 1,350 to about 3,400 (Jansen 1986, p. 539).

For Verviers, this period can be seen as a maturation and saturation period in industrial growth. Though no new companies were founded, 'prosperity reigned' in the two decades after 1850 (Pasleau 2002). However, hygiene was still not developed sufficiently to prevent epidemics such as 1866's cholera outbreak. Only after 1869, with the introduction of the first sewerage water system, did the situation improve (Desama 2013, p. 11).

Aachen experienced a consolidation of what had begun in the decades before, and prosperity reigned here too (Pasleau 2002), as indicated by the following figures of coal production for the district:

Table 8: Coal Production in the District of Aachen, 1850 – 1910 in 1000t

Year	District Aachen	Yearly growth in %	Prussia	Yearly growth in %
1850	359	-	4153	-
1860	632	7.6	10657	15.7
1870	894	4.1	23316	11.9
1879	1131	2.9	36675	5.7
1889	1412	2.5	61437	6.8
1900	1771	2.3	101966	6.6
1910	2745	5.5	143897	4.1

Source: Zapp 1995, p. 280

However, despite continuously high growth rates, the share in overall Prussian production declined from around 10% to about 2%. This is because, from the 1870s onwards, Germany as a whole became a major industrialised country. Though the region around Aachen lost its leading role to the Ruhr region, it remained a centre for industrial development and innovation.

Despite its early railway connection, southern Limburg remained largely rural throughout the 19th century, at least when compared to the other two cities. Industry in Limburg suffered until coal mining began in 1880, when large amounts of coal were discovered around Hasselt (Knotter 2002). Maastricht abandoned its status as a fortified city in 1866, allowing for the enlargement of its territory, and for economic and population growth.

The Liège/Verviers region remained a highly industrialised region throughout the 19th century (Knotter 2002). Unlike Liège, however, the textile industry of Verviers was not able to adapt to new competition, making its industrial and demographic decline inevitable (Alter et al. 2004c, pp. 173, 175) and already visible by the late 19th century.

Despite formal disintegration from the 1850s onwards, industrialisation and population growth in the region as a whole accelerated remarkably. The population of Belgian Limburg grew from 160,000 in 1830 to 210,000 in 1880 while Dutch Limburg's population grew from 186,000 to 240,000 in the same period. At the end of the century, Dutch Limburg clearly outpaced Belgian Limburg because of the discovery of coal in its territory (Jappe Alberts 1974, p. 207) and the resulting migration. From 1852 to 1910, the population of the district of Aachen grew from about 420,000 to 690,000 (Zapp 1995, p. 294), a growth of around 65%.

The second half of the century clearly brought about improvements in livings standards too. Working conditions improved as demand for labour constantly rose, real wages grew as well and, slowly but surely, poverty was eliminated from large parts of society. Rutten shows that, from the mid 1850s, there was no sign of negative correlation between rye prices and height in Limburg. Living standards may thus have increased since then, at least for young males (Rutten 1995, p. 150). In Verviers, the average number of members in a household was 7 in 1806, increasing to 12 in 1846, and going down again to 9 in 1900 (Desama 2013, p. 4), indicating more space per individual and a slow easing of the terrible conditions of early industrialisation. In the district of Aachen, a labour shortage led to competition among employers. Housing and insurance often formed a part of employment contracts (Reckendrees 2014, p. 15)

These are the political, economic and demographic settings in which Würselen, Meerssen, and Sart were embedded in throughout the 19th century. Taking a closer look at the three communes in question, it is possible to dive deeper into the daily lives of the people in this region. This local history section provides the reader with local knowledge about each commune, necessary to correctly interpret the results of the later statistical analyses.

4.1.4 Würselen

Würselen lies about 6.5 km northeast of Aachen. To its west and northwest are the Wurm coal fields. In the 19th century, along the river Wurm, six pits 5 km or less from Würselen mined weakly caking coal. These were the Ath, Furth, Gouley, König, Teut, and Gemeinschaft pits, which were often not in use at the same time. The following table shows coal mining in Würselen from 1800 to 1910 in comparison to the districts of Aachen and Prussia.

Table 9: Mining in Würselen, Aachen and Prussia, 1800 – 1910

	Coal Exploitation in 1000t					
Year	**Würselen**	**Yearly growth in %**	**District of Aachen**	**Yearly growth in %**	**Prussia**	**Yearly growth in %**
1800	14	-	-	-	-	-
1810	10	-2.9	-	-	-	-
1820	24	14.0	143		1021	-
1830	43	7.9	179	2.5	1441	4.1
1840	77	7.9	273	5.3	2551	7.7
1850	66	-1.4	359	3.2	4153	6.3
1860	82	2.4	632	7.6	10657	15.7
1870	175	11.3	894	4.1	23316	11.9
1879	230	3.5	1131	2.9	36675	6.4
1889	302	3.1	1412	2.5	61437	6.8
1900	249	-1.6	1771	2.3	101966	6.0
1910	273	1.0	2745	5.5	143897	4.1

Source: Zapp 1995, p. 280

The coal production figures for Würselen roughly fit into the periodisation established above. There is considerable growth in coal production after 1810 (in 1817, the Gouley pit was modernised), which accelerated enormously during the 1860s, a development comparable to the districts of Aachen and Prussia.

In terms of demography, the development was somewhat different. Though there was considerable population growth for Würselen at the beginning of the century, it fluctuated considerably when compared to the rapid but constant population growth in the district of Aachen.

Table 10: Population of the District of Aachen and Würselen 1803 – 1910

Year	Population in the District of Aachen	Yearly growth in %	Population in Würselen	Yearly growth in %
1803			3300	
1817	310619	-	3462	0.4
1828	348629	2.4	3979	1.4
1831	354629	0.6	4150	1.4
1837	369103	0.7	4380	0.9
1843	394451	1.1	4877	1.9
1852	420436	0.7	4947	0.2
1858	446663	1.0	5135	0.6
1864	472018	0.7	5340	0.7
1871	490810	0.6	5464	0.3
1880	524097	0.8	6643	2.4
1885	544056	0.8	7318	2.0
1895	590124	0.8	9185	2.6
1900	614964	0.8	10203	2.2
1910	691598	1.2	13084	2.8

Source: Zapp 1995, p. 294

While the rapid growth from 1817 to 1828 can be explained by the first economic growth phase in Würselen, the stagnation in growth from 1843 to 1852 was probably due to the economic downswing from the German Revolution. Because of its size though, such developments were not visible for the entire district of Aachen. Taken together, the figures point to a degree of short-distance migration. People searched for employment elsewhere or temporarily migrated back to the countryside in times of trouble. In the last decades of the century (from 1895 onwards), Würselen experienced large economic and population growth, following general patterns in Prussia at that time. With demographic growth came a higher degree of urbanisation, as the following table shows:

Table 11: Houses and Number of Inhabitants per House in Würselen, 1813 – 1895

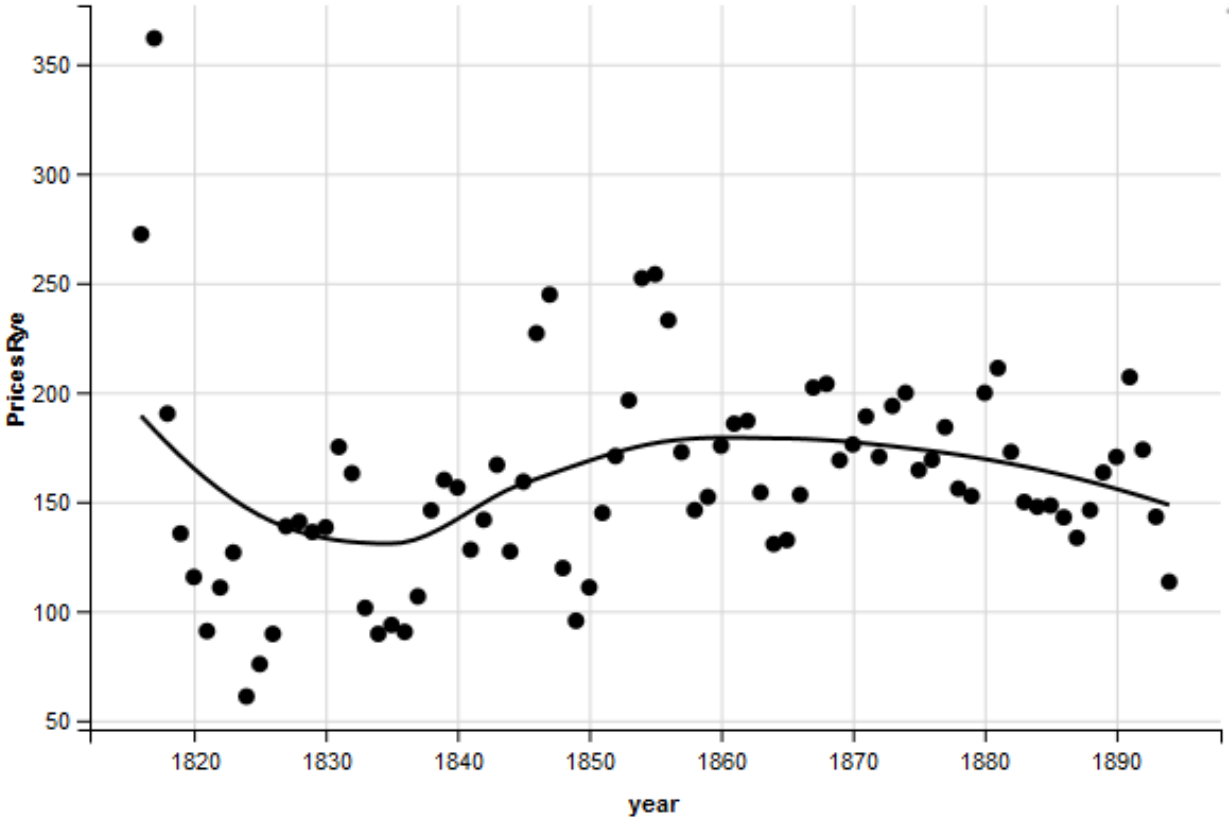
Year	Number of houses	Number of inhabitants per house
1813	667	5.1
1826	751	5.1
1852	786	6.2
1871	915	6
1895	1266	7.3

Source: Zapp 1995, p. 309

Table 11 shows the number of houses and their average number of inhabitants in Würselen from 1813 to 1895. The average number of inhabitants per house will be taken as a proxy for urbanisation, as migration towards cities usually results in housing scarcity, resulting in higher rents, and forcing individuals to share living space. The table shows that, during the first quarter of the 19th century, an average of 5.1 people lived in a household, while by 1852 the figure had reached 6.2. The situation worsened during Würselen's industrial growth phase (which began in the 1860s), and there were more than 7 people per household by the end of the century. In such environments, diseases constantly occurred. They remained a constant and deadly threat until the mid 1860s, when drinking water and health care conditions improved (Liebenwein 1995, pp. 126, 135).

According to The Mayor's Chronicles for 1824 to 1864, grain was clearly the staple food of Würselen's inhabitants. This was followed by potatoes, which surpassed gross grain output in the mid-1860s. While 1kg of cooked potatoes has about 730 kcal, a 1kg loaf of rye, wheat, or oats gives about three or four times as many (Netzer 2001), (dependent on the quality of the crop and preparation). Rye and oats are the main grains cultivated in Würselen, and their output is comparable in size (source: The Mayor's Chronicles, author's own material). However, while rye is usually produced for self-consumption, oats are usually converted into animal feed. Weak correlations between grain prices from 1824 to 1868 (Rye & Wheat 0.48, Rye & Oats 0.34, Wheat & Oats 0.32) indicate market integration and substitution effects that are rather weak.

Figure 7: Yearly Rye Prices in Cologne, 1815 – 1900

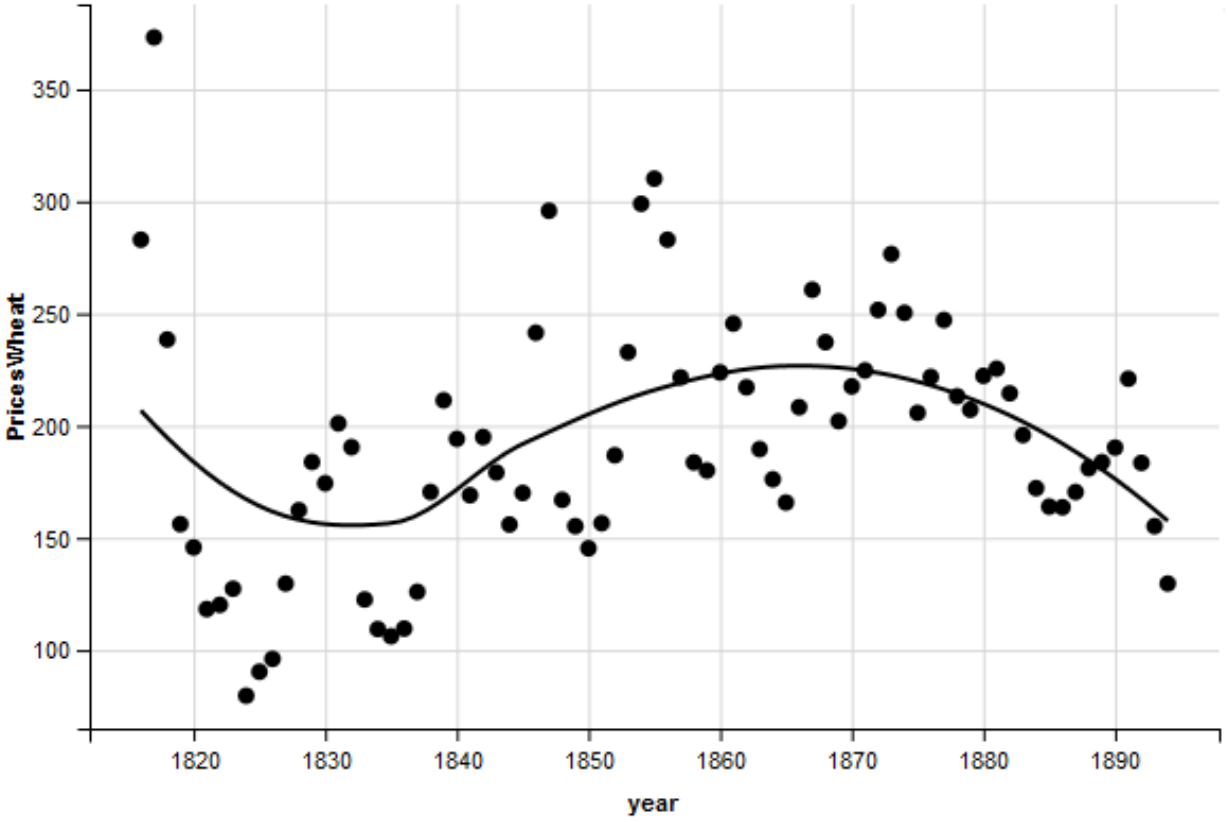


Prices in Mark and Reichsmark/1000kg
Trend: Loess Regression with span = 0.75
Source: https://histat.gesis.org/histat/de/table/details/21C1267E2CAAF259ABD20627BD2F1B3E#tabelle#

Figure 7 shows the nominal rye prices for Cologne in the 19th century (1815-1900). Geographically, it is the closest consistent time series available for Würselen, and should therefore be taken as an indicator for economic stress. The graph shows high rye prices at the beginning of the century, which were caused by the French wars. These high prices were then followed by a decline and then volatile growth, which lasted until the mid 1850s. Price fluctuations become less volatile from the late 1850s onwards, indicating higher market integration of rye as a commodity. This observation is backed up by the coefficients of variation (CV) for the periods established under 3.5 (adapted to the available price data): 1816-1839: 0.46; 1840-1869: 0.24, 1870-1899: 0.16. With transportation and information costs falling from the second half of the 19th century onwards (Pfister 2009, pp. 431f), price volatility steadily declined throughout the century. Less price volatility and market integration led to fewer hardship years per decade and a decline in the correlation of these short term crises with demographic reactions.

Some studies have shown that demographic responsiveness is often stronger for wheat prices than rye, though rye might be the main staple food (Matuzak and Borovik 2017). It is possible that wheat is the cash crop of the peasants when this phenomenon occurs (Kopsidis, Bruisch Summer 2018). Wheat was also the second most-traded crop in Cologne in the 19th century, and therefore also requires closer examination:

Figure 8: Yearly Wheat Prices in Cologne, 1815 – 1900



Prices in Mark and Reichsmark/1000kg
Trend: Loess Regression with span = 0.75
Source: https://histat.gesis.org/histat/de/table/details/BC9C93BA6A2E7447A67208942C68EAB5#tabelle

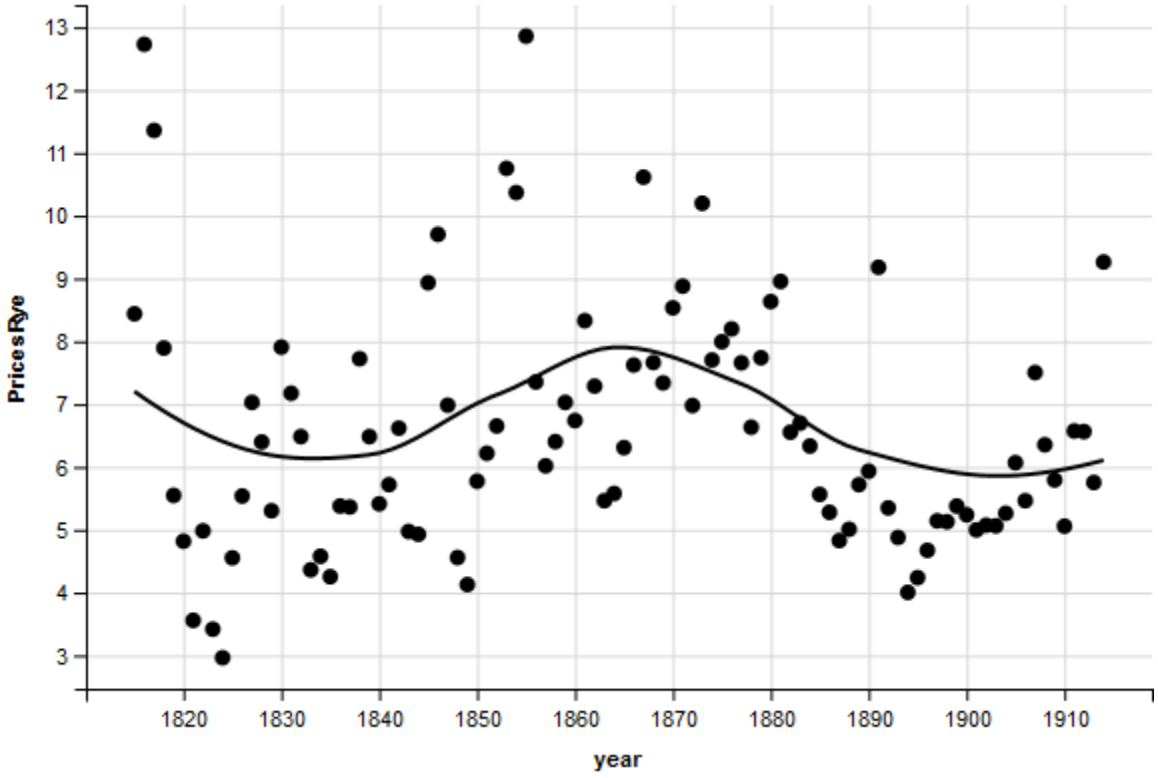
Both the overall trend and peaks and lows are very similar to those of rye. With the coefficients of variation for 1816-1839: 0.41; 1840-1869: 0.22, 1870-1899: 0.17, only small statistical differences can be found. Unsurprisingly, the correlation between the yearly changing rates of rye and wheat prices in Cologne is very high, with a correlation coefficient r = 0.87. As detailed in 3.5, these Cologne prices fill up the incomplete prices for Würselen, originating from the Mayor's

Chronicles, themselves indicating less volatility because of a low CV of 0.09 for rye and one of 0.14 for wheat for 1824-1865.

4.1.5 Meerssen

Meerssen is part of the Southern-Limburg Plateau Area. It lies around 6.5km northeast of Maastricht. From 1847 to 1870, the community of Meerssen had 50-70% arable land, 10% orchard land, and 15-20% meadow land of a rather poor quality. In Meerssen, most of the grain was kept for self-consumption, especially rye, with the rest used as animal feed. In the first half of the 19th century, according to Oberndorff and Niesten, only industrial and large scale production could produce sufficient surpluses to sell additional grain (Oberndorff and Niesten 1994, p. 206). The influx of American grain in the last quarter of the 19th century forced Meerssen's agricultural economy to modernise. This modernisation gave the city strong output growth from 1895 to the First World War (Oberndorff and Niesten 1994, pp. 206f). The prices are taken from Maastricht's market, the closest market to Meerssen with available time series.

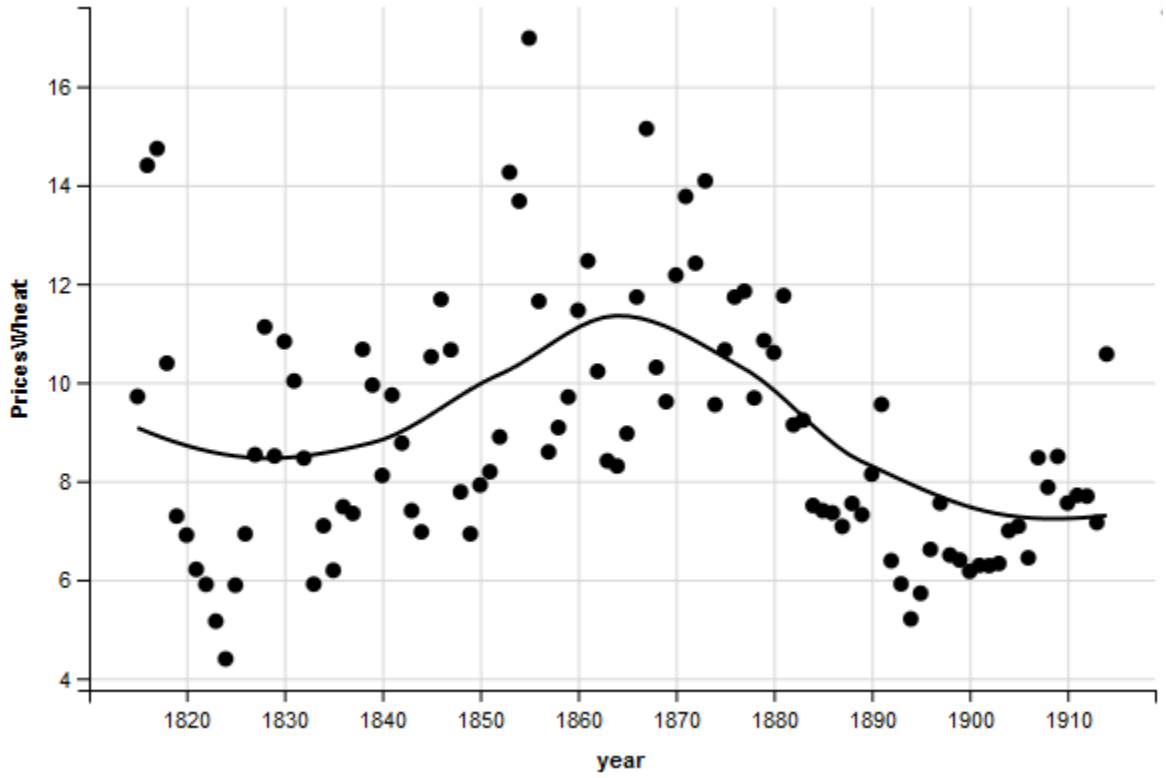
Figure 9: Yearly Rye Prices in Maastricht, 1815 – 1914



Prices in Gulden/100kg
Trend: Loess Regression with span = 0.75
Source: Tijms 1983, appendix.

The pattern of price volatility appears comparable to that of Cologne: high prices at the beginning of the century are followed by a decline and then volatile growth until the mid 1850s. However, unlike Cologne, there is a higher degree of volatility until the 1870ies or 1880ies, supported by the coefficients of variation (1815-1839: 0.41; 1840-1869: 0.28, 1870-1899: 0.25), indicating that crises years might have been an issue for longer in Meerssen than in Cologne. The data on grain prices for Maastricht is slightly more favourable than for Würselen and Cologne, as there are available time series similar to those of rye prices for wheat, barley, and oats for the entire century. As for Würselen, it makes sense to show the development of wheat prices for Meerssen, being the second most important crop in terms of output.

Figure 10: Yearly Wheat Prices in Maastricht, 1815 – 19



Prices in Gulden/100kg
Trend: Loess Regression with span = 0.75
Source: Tijms 1983, appendix.

Again, both the overall trend and the yearly wheat prices in Meerssen correspond to those of rye. The correlation coefficient r is almost the same here too when compared to rye and wheat in Cologne: r = 0.85. The inter-city price correlation for Maastricht and Cologne, however, is much lower: the correlation coefficient of the yearly change rate for rye is 0.55 and for wheat is 0.58, indicating some (but not a great deal of) market integration between Limburg and the Prussian Rhine-Land in the 19th century. Furthermore, the coefficients of variation of wheat (1815-1839: 0.31; 1840-1869: 0.24, 1870-1899: 0.27) further support the idea that price fluctuations were an issue until the end of the century. As will become clear when comparing these coefficients to Sart's, the coefficient of variation for wheat, 0.27, is the highest of all the crop prices depicted here in the last period.

With Maastricht's industrialisation, in 1840, industrialised paper production was introduced in Meerssen by Tielens & Schrammen. In 1850, the factory employed 98 workers, and 230 by 1854 (Oberndorff and Niesten 1994, p. 203). Later in the century, Regout's porcelain factory, the Son´s

and Sphinx's pottery, and the tile and brick makers in the region increased their workforces. In 1902, around 1,000 people were working in the factories of Meerssen (ibid.).

In terms of demography the development indicates similarities with Würselen as well. Table 12 shows the population, the number of houses, and the average number of inhabitants per house for Meerssen:

Table 12: Population and Number of Houses in Meerssen (Centre) 1815 – 1899

Year	Population	Number of Houses	Number of inhabitants per house
1815	1545	309	5
1818	1562	325	4.8
1823	1632	NA	NA
1830	1738	320	5.4
1849**	2591	401	6.5
1899**	5173	877	5.9

Source: Oberndorff and Niesten 1994, pp. 168f;
*Commune of Meerssen[43]

Pointing towards urbanisation, the figures show signs of household sizes increasing throughout the middle of the century, then decreasing at the end of it. Development is less pronounced here than for Würselen.

A closer look at life events brings further insights. Table 13 shows Meerssen's population, number of births, deaths, and the respective migration residual compared to population figures for the respective year:

[43] http://www.volkstellingen.nl/nl/volkstelling/jaartellingdeelview/VT184906/index.html, http://www.volkstellingen.nl/nl/volkstelling/jaartellingdeelview/VT189911/index.html, own calculations.

Table 13: Population and Life Events in Meerssen, 1849 – 1911

Year	Population	Births	Deaths	Migration Residual	Yearly Population growth in %
1849	2190				
1853	2321				1.5
1862	2436				0.6
1876	3024	103	59	189	1.7
1881	3648	123	57	261	4.1
1891	4145	135	94	313	1.4
1901	5273	216	105	503	2.7
1911	6515	248	105	568	2.4

Source: Oberndorff and Niesten 1994, p. 222

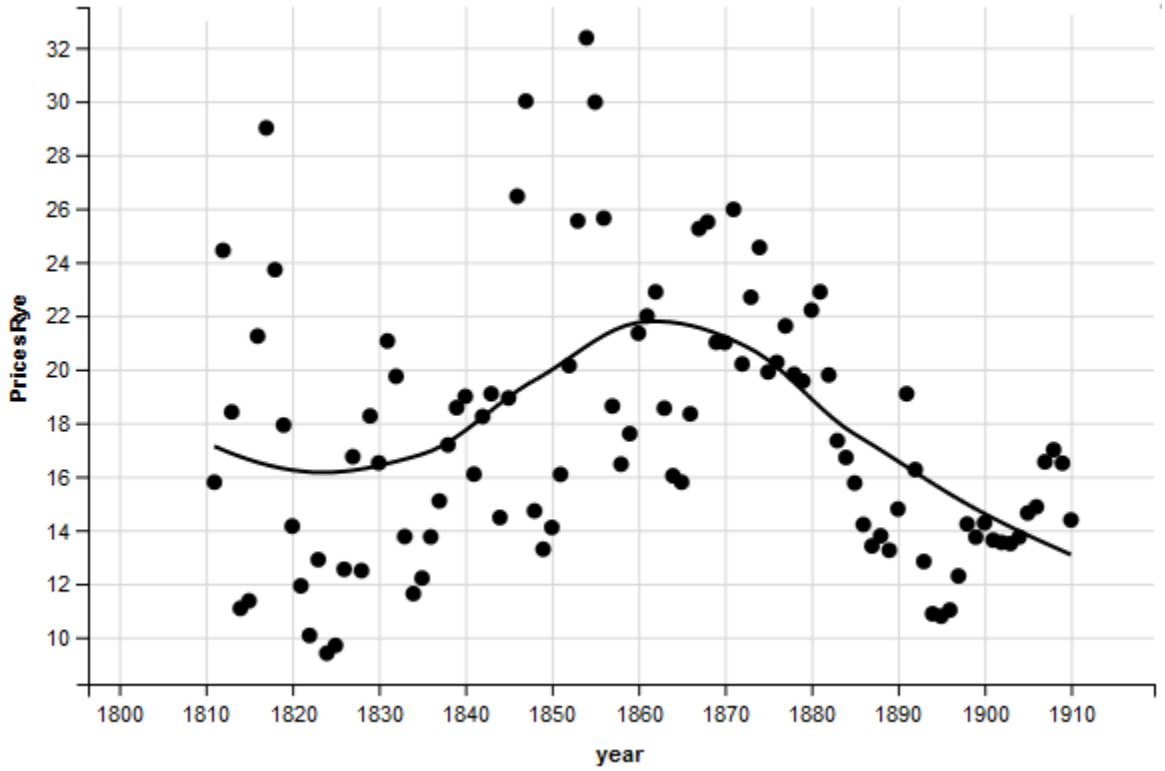
According to tables 12 and 13, Meerssen experienced population growth at the end of the French period (very much like in Würselen) and strong population growth from the 1870s onwards, mainly due to migration surplus and natural growth.

Meerssen is thus comparable to Würselen: both Meerssen's demographic and economic development and opportunities for finding work were similar. Work opportunities in the coal fields of Würselen are met by those in Meerssen's factories.

4.1.6 Sart

Sart is located about 12km south/southeast of Verviers, in the Ardennes Forest. Today, it is part of the commune of Jalhay, with a total population of about 8,400. In the 19th century, the Ardennes Forest region and Sart were characterised by small farming. The main crops for food production were rye, oats, and spelt, with potatoes slowly increasing in output from the end of 18th century onwards (Carmanne 2005, p. 129). In the first half of the 19th century, agricultural output in the commune was insufficient for nourishing its inhabitants. Instead, additional grains had to be imported and the people of Sart were strongly dependent on market prices for grain. Improved agriculture and outward migration meant that links for rising prices and rising mortality disappeared in the 1850s (Alter et al. 2004c, p. 192).

Figure 11: Yearly Rye Prices in Liège/Belgium, 1811 – 1910



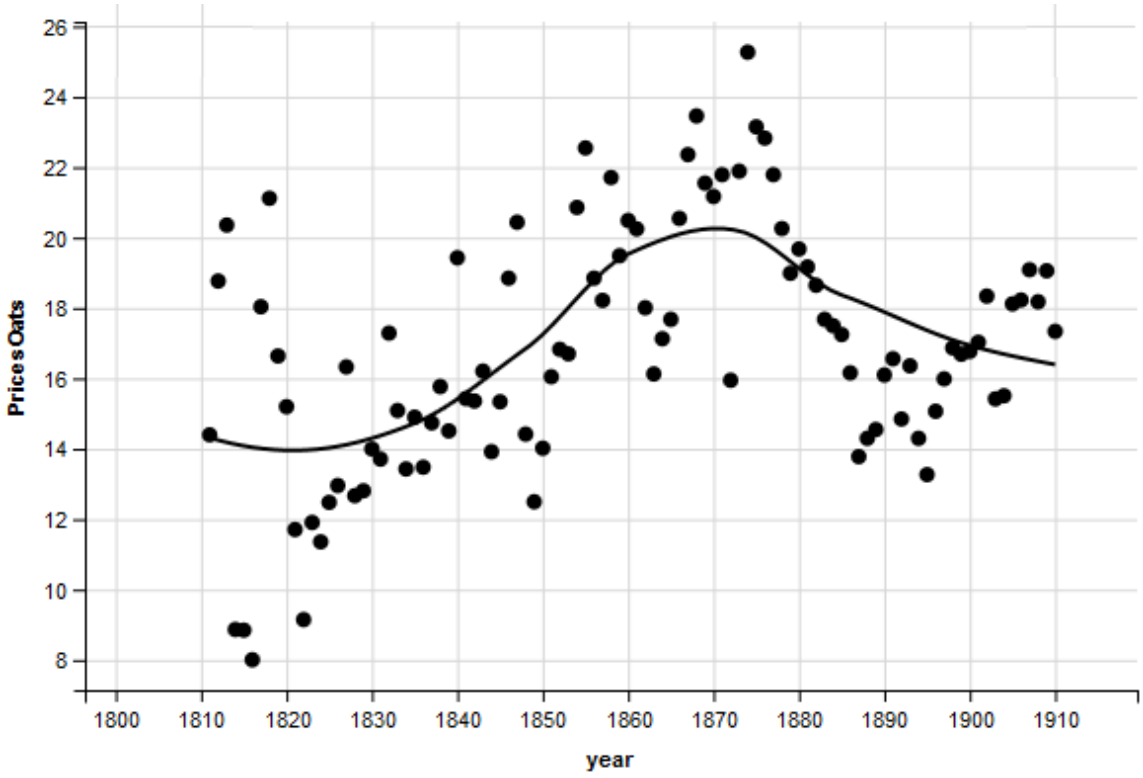
Prices in Franc/100kg
Trend: Loess Regression with span = 0.75
Source: EAP Data, courtesy of George Alter and Michel Oris

When comparing the Belgian/Verviers prices to those of Cologne, a high correlation coefficient of r = 0.82 is found. A much lower correlation is observable between Verviers/Belgium and Maastricht. A correlation coefficient r of only 0.43 indicates much lower market integration on this side of the Border Triangle. The coefficients of variation for rye for 1811-1839: 0.30; 1840-1869: 0.25, 1870-1899: 0.25 indicate relatively low fluctuations in prices from the beginning of the century. These decrease only minimally in later periods. The rather stable price development can mainly be explained by the time series itself. As explained above, nationwide aggregate prices were often taken to fill in missing data for Vervier's market.

The next graph shows the yearly prices of oats from 1811 to 1900. Oats are taken here instead of wheat as they had the most impact on demographic effects in the mortality and fertility studies of the EAP (Alter et al. 2004c, 2010), and are therefore the most promising crop for indicating economic stress for locals. Unlike prices for Würselen and Meerssen, those for Sart do not always

refer to the market prices of a nearby industrial centre. Where the EAP researchers found no prices for Verviers or Liège, the Belgian average price was taken instead.

Figure 12: Yearly Oats Prices in Liege/Belgium, 1811 – 1910

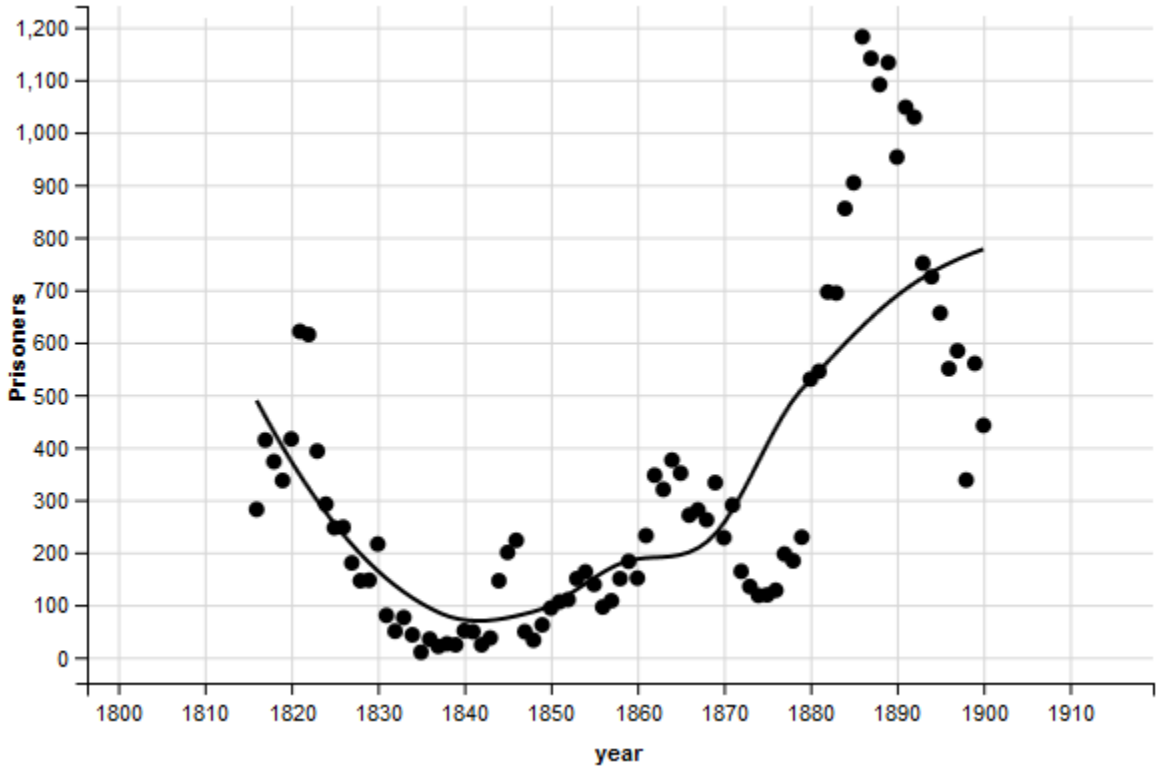


Prices in Franc/100kg
Trend: Loess Regression with span = 0.75
Source: EAP Data, courtesy of George Alter and Michel Oris

The pattern for oat prices looks different to the other crops, not so much for the variation in yearly prices but for the overall trend. In the last quarter of the century, prices for oats declined less than rye and wheat. For oats, the coefficients of variation of 1811-1839: 0.23; 1840-1869: 0.16, 1870-1899: 0.17, point towards less price fluctuation for oats from the 1840s onwards. In Sart, small home crafts were widespread but declined quickly after the early onset of the industrial revolution in Verviers. Only after the 1873 depression, caused by an influx of cheap American grain, a shift from subsistence to commercial agricultural production occured. As the graphs for Belgium/Verviers show, this comes together with a decrease in nominal grain prices. Market integration development was thus similar to Meerssen, but must have been later than Würselen.

The Sart prices are mostly Belgian average values, however, and hardly comparable. For Sart, it makes sense to add further time series that have the potential to indicate short term economic stress, as with the number of short term prisoners (remember that petty crime was an option for smoothing economic stress, according to our theoretical framework). The following figure shows the number of short term prisoners in the 'passage house' (*maison de passage*) of Verviers that also received delinquents from the surrounding areas.

Figure 13: Yearly Short-Term Prisoners in Verviers Prison, 1815 – 1900



Trend: Loess Regression with span = 0.75
Source: Belgian State´s Archive in Liège, prison registers of the prison of Verviers, author's own material

The figure shows a high number of short term detainees during the beginning of the period, soon after the turmoil of the Napoleonic wars. Then, even though the population of Verviers was growing, the absolute number of short term detainees steadily declined over the next three decades (with the exception of 1830, the year of the Belgian revolution). An increase is found during the years of industrial crisis and the last Belgian subsistence crisis in the mid 1840s (Vanhaute 2006), with numbers further rising in the 1850s and even more so during the 1860s, when Verviers' golden

age drew to a close. Verviers' population more than doubled until the 1860s, which diminishes the relative figures to a large extent. Still, it seems that crisis and petty crime are somehow related in Verviers. This conjecture will be tested in the statistical models. In any case, while the downswing in the number of short term prisoners in the 1870s is explained through the stable maturation phase of Verviers' economy, the large increase afterwards can only be explained through an even stronger population growth (that indeed took place, as seen above) or through the possible extension in the prison's capacity. No large crisis is known to have taken place in these years that would otherwise explain this growth.

Sart is a relatively isolated commune when compared to the other two, something that surely comes from its distance from an industrial centre. The EAP researchers found that living standards were very low in the region around Sart throughout the 19th century: according to Alter, Neven, and Oris, men in Sart were about 4 cm shorter than the Belgian average. Additionally, the commune of Sart had significant debts until 1868. In this year, the debts were paid back through the selling of 100ha of communal forest land (Carmanne 2005, p. 110; Belgian State Archive in Liège, communal accounts, author's own material). Thanks to its isolation, however, Sart was mostly spared the large air-borne diseases which crossed Belgium semi-regularly (1832-1834, 1848, 1854, 1859, 1866, 1874, and 1892-1894; Alter et al. 2004c, p. 184).

Because of its relative isolation, Sart was quite different to the other two communes in terms of industrialisation: the state archive in Liège shows that only six machines, mainly textile machinery, were imported to Sart between 1847 and 1898 (Belgian State Archive in Liège, inventory, author's own material). Like Würselen and Meerssen, Sart was surrounded by industrial centres, but unlike the former two it did not take share their heavy industrialisation processes.

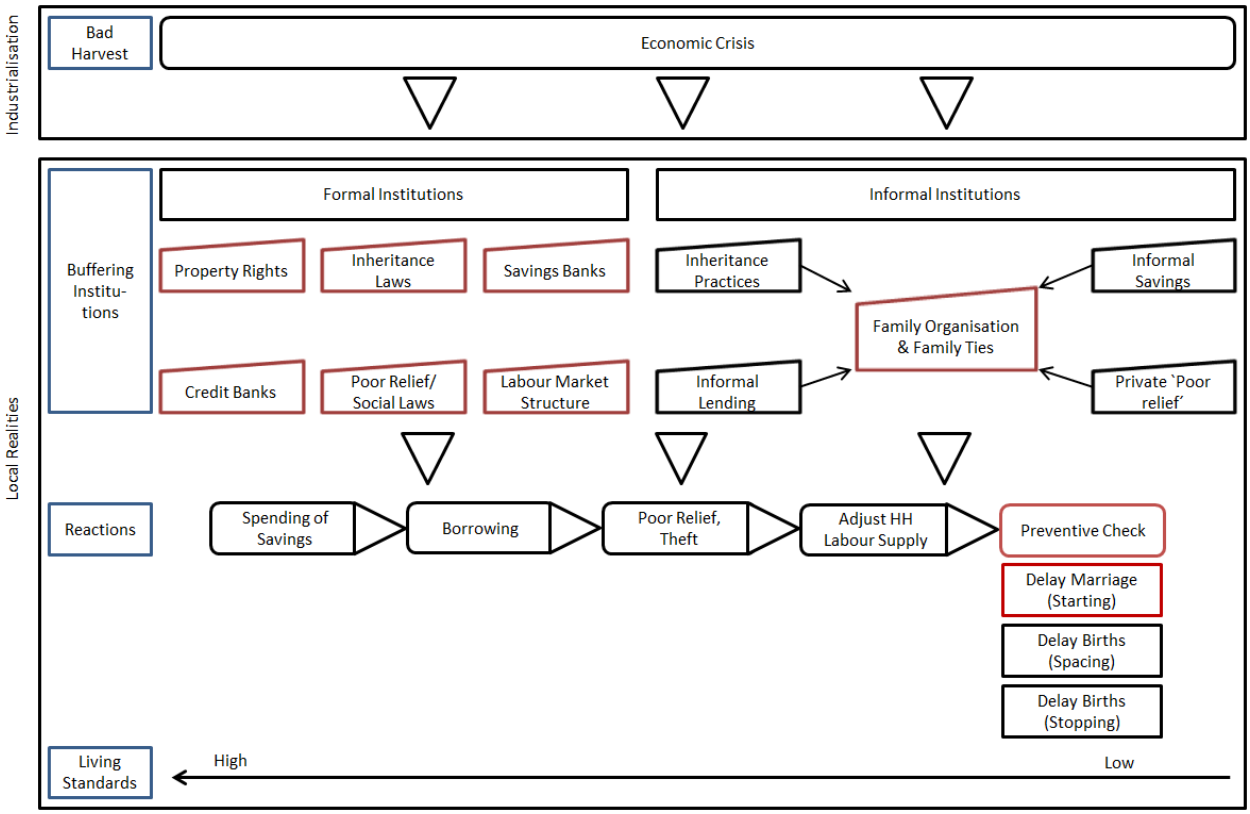
Demographically, Sart differs substantially in terms of development: Sart grew from 1,800 to 2,400 inhabitants from the Napoleonic wars to the mid-19th century, only to experience a decline in the period that followed, caused by strong emigration. By 1900 it had returned to the level of the beginning of the 19th century, with about 1,800 inhabitants (Alter et al. 2004c, p. 177). This large-scale emigration led the remaining peasants to consolidate farm sizes (and values), meaning productivity rose, first purely through scale and later because of fertilisers (Alter et al. 2010, p. 200).

It is important, for the later analyses, to establish a local classification of the periodisation undertaken above for the entire region. Only with such a periodisation will it be possible to establish statistical models that can be split into meaningful periods and allow for correct interpretations of the results with respect to the commune in question. When summarising what has been detailed in 4.1, the first signs of industrialisation are visible very early on for Liège and Verviers. With a delay of about ten years, Aachen follows the patterns of the former until, five years later, early industrialisation comes about in Maastricht in the 1830s. While both Aachen and Maastricht catch up in terms of the speed of their development throughout the course of the century, Liege and Verviers remain the drivers for industrial development in the region until the late 1860s. Where possible, the following three periods will be constructed in the later modelling: 1) 1810 – 1839, 2) 1840 – 1869, and 3) 1870 – 1899. The first two observation periods will be periods of transition: from pre-industrial or early-industrial to highly industrialised. As described previously, these two periods are ones of drastic change and of large economic pressure for the population. The vulnerability of individuals and couples to this pressure should become clear here in terms of demographic reactions. The third period is entirely situated in the highly industrial period. The idea is hereby that a degree of industrialisation was reached that should have ensured enough market integration to keep prices more constant, provide a relatively stable and high level of real wages, and therefore make people resilient to short-term economic pressure. When this periodisation is not possible, for instance, because of overly unequal distribution of the data, reasonable periodisation alternatives will be provided.

4.2 Reconstructing Institutions

For a reminder of what has been established as the theoretical framework, we return to Figure 6:

Figure 6: Economic Stress, Attenuating Institutions and Demographic Reactions



Source: own illustration

Each reaction to short-term economic stress and the relevant institution for each commune will now be examined, following the guidelines from the theoretical part (2.2). Instead of a mere description of economic stress attenuating institutions, however, the aim of this sub-chapter is to determine which institutions influence the reactions of individuals and couples to economic stress and which do not. It makes sense to focus on those institutions which indeed have or have the potential to do so in the upcoming analysis and to include only those institutions into the statistical modelling.

4.2.1 Spending of Savings

While property rights are important for fostering economic growth (see Chapter I), with respect to this study, it makes sense to analyse them from the perspective of property of land for the reasons given in 2.2: with the Napoleonic Code, the entire region had these property rights chartered in 1804. Property rights were so important to the French government that they found their way into the French Declaration of the Rights of Man and of the Citizen in its 17th article: « La propriété étant un droit inviolable et sacré, nul ne peut en être privé, si ce n'est lorsque la nécessité publique, légalement constatée, l'exige évidemment, et sous la condition d'une juste et préalable indemnité. » (Property being an inviolable and sacred right, no one can be deprived of private usage, if it is not when the public necessity, legally noted, evidently requires it, and under the condition of a just and prior indemnity).

These property rights remained in the region throughout the 19th century (Boring 2014, p. 2), granting integrity to the property of each individual or family. The material gathered shows no significant differences between either the three French departments or the later regional/communal entities across the borders. As institutional differences cannot be found here, there will be no opportunity for determining property rights as one of the main institutions that trigger the emergence of heterogeneity in demographic decision making.

This statement seems to also apply to the legal institution of inheritance laws: in January 1794, the French Revolution brought about the Law of Nivôse, announcing what was about to come to the three provinces with the Napoleonic Code: the strict, equally-distributed division of the father's (surviving spouses were intentionally left out) property in cases of succession. "Universal succession became the principle under the Civil Code, meaning that the heirs inherit both the rights and liabilities [!] (sic.) of the decedent" (Boring 2014, pp. 3f). As with the entire Napoleonic Code, these articles were valid for all three regions from 1804 onwards.

The French laws mostly remained in place throughout the Border Triangle after Napoléon's defeat in 1814. From 1815 to 1900, they comprised a special code of the legal system for the Prussian Rhine Provinces called "Rheinisches Recht" (Rhenish Law). During this period, the legal institutions of Paris, not Berlin or anywhere else, served as guidelines for the judicature in the Rhineland. Changes in the law made in Paris were mostly followed and adopted by Rhinish jurisdictions (Strauch 2014, §15). Only in 1900 was the Napoleonic Code eventually replaced with the Bürgerliches Gesetzbuch, which was partly influenced by French/Rhinish law too (Strauch 2014). For family and inheritance law in 19th century France, there were not many changes. The

only change relevant to this study occurred in 1891, when a law was passed that guaranteed "the surviving spouse's use (though not necessarily ownership) of a quarter of the decedent's property" (Boring 2014, p. 4). However, this occurred so late in the period being studied that its impact will be negligible on the overall research question.

The situation in Limburg was similar: the Napoleonic Code was in fact replaced by the Dutch Civil Law in 1838, but regulations concerning inheritance remained unchanged. This law proclaiming in Article 4:11 that "Shares in the estate of a deceased", that "[t]hose who are called as intestate heirs to the estate of a deceased, inherit for equal shares" (Dutch Civil Code 2017, Article 4:11), the 19th century can be considered very stable in terms of jurisdiction. As with the District of Aachen, these heirs were solely men throughout the 19th century.

In the former department of Ourthe, though differently planned (the in 1831 enacted Belgian Constitution intended a revision of the Five Codes), the situation in the Province of Liège was essentially the same, as this revision never took place. Instead, only minor changes occured throughout the 19th century (Piret 1954, p. 753), and these were too late in the period to have any impact on this study. One example is the strengthening of the wife's position, which came about in 1896, ameliorating her position only to a very minor extent by making her the heir of the belongings of the family if (and only if) there are no children (Piret 1954, p. 771). For formal inheritance *laws*, therefore, there will be no opportunity for comparison. Informal inheritance *practices*, however, might still differ. Subchapter 4.2.5 will investigate this further.

Important differences are instead found in the formal institution of savings banks: some prototype savings banks can be found in Prussia later into the Age of Enlightenment, such as in Altona in 1801. These were more like private clubs than banks and were the result of typical Enlightenment thinking, like self-determined lives and the actions of the individual, as well as taking responsibility for one's self (Wehber 2013b). Savings banks could also be established by the local authorities, which came into play in a decisive manner when the Prussian state strengthened the autonomy of its municipalities through the Municipal Ordinance of 1808 (ger.: Städteordnung) after their crushing defeats in Jena and Auerstedt against Napoléon's armies (Proettel 2016, p. 6). In 1839, Prussia had 85 savings banks, and 1,500 in 1900. The Prussian Savings Bank Law, enacted in 1938, was mainly responsible for this rapid development ("Reglement, die Einrichtung des Sparkassenwesens betreffend"; source: State's Archive, Vienna). It continued the success story of savings banks in Prussia, and initiated increasingly pronounced diffusion (Wehber 2013b). The

Prussian savings banks thus achieved their objective of creating 'savings possibilities where they had been lacking before' (Wysocki 1990, p. 25). The banks' business was regionally restricted from the beginning, as their mission was not profit maximisation. According to the idea of common welfare, German savings banks instead served the public good. Surpluses were used to back social, educational, and cultural measures (Thomes 2013, p. 57). Through these banks, savings and credits would help to bridge individual financial crises when social security depended on family networks which had started to dissolve (Thomes 2013, p. 48). However, despite the success story of savings banks in Prussia/Germany, and the positive image given by Wehber (Wehber 2013b), Wysocki and Schulz find that savings banks added little to the fight against poverty: those so poor as to be unable to make a living could not save anything. Potential savings banks customers, therefore, did not suffer from poverty but had an income above subsistence level. For every savings bank in their research, Wysocki and Schulz found that less than 50% of the clients belonged to the lowest strata of society, the strata they were aimed at from 1815 to 1839 (Wysocki and Schulz 2005, p. 77).

Turning to Aachen and its savings bank, the situation is much more positive: the first public savings bank for the district and the city of Aachen was opened in 1829, the first private one in 1834 (Spar- und Prämienkasse des Aachener Vereins zur Beförderung der Arbeitsamkeit von 1834). The former can be understood as a 'normal' savings bank, in the sense of the later Prussian Savings Bank Law of 1838: it aimed to help the lower classes to establish saving opportunities. The guaranteed amount of 4% p.a. interest rate was important, along with the simple fact that such an institution was geographically nearby. The latter premium savings bank was founded as a result of the 1825 Aachen Fire Insurance Company (Aachener Feuerversicherung) and the Aachen Club for Fostering Industriousness (Aachener Vereins zur Beförderung der Arbeitsamkeit). It is remarkable that its nature and statutes were explicitly dedicated to diminishing poverty as much as possible through charity and security during sickness, unemployment, or hard times in general, and through "helping people to help themselves". With a minimum amount of only 1 Mark[44] of

[44] For an idea of the purchasing power of one Mark: according to the Statistisches Bundesamt, 1 Mark in 1873 had the purchasing power equivalent of €6.3 in 2016 (Wissenschaftlicher Dienst des Deutschen Bundestages 2016). For real wages, the average income of a worker in the metalworking industry in 1854 was about 8 Marks per week, and about 5 Marks in the textile industry. In the same year, 1 kg loaf of rye bread cost 45 pence, and thus 3.15 Marks per week, assuming the consumption of one 1 kg loaf of bread per day for a family of, say, one elderly grandparent, mother and father, and 2-3 children. A 1 kg loaf of wheat bread would cost 4 Marks per week. Prices were twice as high for pork and beef (Hoffmann 1965, pp. 468, 578, 584, own calculations). See 4.2.4 for another example.

savings, an interest rate on savings that was higher, on average, than the public bank by 2.5%, and an out-payment of financial bonuses for the poorer classes (including the unemployed and the sick), this bank was able to create savings incentives and attracted the people it had intended to (Kähler 1910, p. 382). Throughout the century (1834-1908), a top down redistribution of about 15 million Marks took place through the out-payment of bonuses alone. Another 9 million Marks were spent on education for the poor in the same period by the bank (with its club's support). About 2 million Marks were spent on purposes which at least concerned poor relief and poor care (Kähler 1910, pp. 382f, 397).

Table 14: Deposit Books in the Premium Savings Bank of Aachen, 1835 – 1908

	Share of deposit size in %					
Year	**Total**	**0-60 Marks**	**60-150 Marks**	**150-300 Marks**	**300-600 Marks**	**600-1000 Marks**
1835*	1633	87	9	5	4	-
1855	12689	24	23	18	34	-
1875	48700	22	17	16	46**	-
1908	89015	25	12	12	14	37

*Figures as in original source. Totals do not always add up to 100%, possibly due to double counting or missing values
**300 - 900 Marks
Source: Kähler 1910, p. 384

Table 14 shows the percentage of deposit books in the premium savings bank of Aachen from 1835 to 1908. In the early period of its existence, the bank's deposit books are to 96% of a maximum of 150 Marks. The later years of the century are characterised by a larger share of accounts which contain 300-1000 Marks, indicating both increasing wealth (though surely less pronounced when accounting for inflation) and the bank's success. The number of deposit books increases strongly throughout the entire period, and the premium savings bank of Aachen was a true success story.

But to what extent did all of this affect the people of Würselen? The secondary sources do not reveal the number of accounts per year for the people of Würselen. However, Wysocki and Schulz make an interesting observation for the share of clients per km for the savings bank of Mindelheim in 1842:

Table 15: Client Distribution for Distance from the Savings Bank of Mindelheim (Bavaria)

Distance of home of client from Savings Bank in km	Number of Clients	Clients in %	Add Up
2-4	84	20,6	20.6
5-8	166	40,7	61.3
8-13	105	25,7	87
14-19	14	3,4	90.4
20-25	26	6,4	96.8
NA	12	3,1	99.9*
Sum	407	100,0	100

*due to the rounding of Wysocki and Schulz
Source: Wysocki and Schulz 2005, p. 150

With infrastructure and transportation generally improving, it can be expected that the shares of clients from further away increased slowly and steadily over time. In any case, 87% of the clients came from a distance of up to 13km. Applying this proxy to Würselen, one can conclude that the inhabitants were not only affected by the premium savings bank of Aachen, but also played an important part in its success.

Late in the century, rural credit cooperatives (of the Raiffeisen type) appeared. They were another success story, providing savings and credits for farmers. However, as they had no impact until the very end of the century (Bracht 2013, p. 146), they will be neglected from the further course of this study.

Like in Prussia/Germany, savings banks in the Netherlands gradually developed through the Enlightenment. The "Maatschappij tot Nut van ´t Algemeen" (Society for Public Welfare) was founded in 1784 by the liberal bourgeoisie, with the aim of creating better conditions for the lower classes. From these ideas, the Nutsspaarbanken (a non-profit saving banks) emerged in 1817. However, their story isn´t quite comparable to their counterparts in Germany. In 1900, 1 in 4 Prussians (Wehber 2013b) had a registered savings bank deposit book, while only 6-7% of the Dutch had one in the same year, about 1 in 15. Surprisingly, this rather low number appears only after several years of growth for the savings bank. Three decades earlier, only around 2.5% of the

Dutch had a savings bank deposit book, or every 40th person in the Netherlands (van Leeuwen 1996, pp. 247ff).

The first savings bank in Maastricht was established by the "Maatschappij tot Nut van ´t Algemeen", and was in operation from 1827 to 1835, shutting down during the Belgian Revolution. The second trial was not very successful either: due to insufficient public welfare (van Leeuwen 1996, pp. 247ff), the city administration reopened the savings bank. This time, it was in operation from 1835 to 1848 (Cornips 1953, pp. 10–14). In its initial idea of preventing poverty, the Maastricht savings bank was quite similiar to the savings bank in Aachen: the bank offered an interest rate of 3% for the clients from 1854 throughout the rest of the century. However, additional bonuses and similar are unknown, and the number of clients remained disappointing to officials. Both of these trials were unsuccessful, and would have been perceived as failures. In 1841 the bank had 132 clients, 240 in 1847. When using the proxy established for Mindelheim on Maastricht, a rough estimation tells us that around 60% of its clients came from the suburban ring around Maastricht. Assuming, for simplicity, that all of them came from Meerssen, a maximum of 60 clients in 1841 and 120 in 1847 would be possible, with the real figures surely lower. The failure of the bank becomes obvious in 1848, when the bank was closed due to large deficits (Jansen 1986, p. 543). Only in 1853, 26 years later than in Aachen, was a stable savings bank which was actually used by clients in significant numbers established in Maastricht. When compared to the rest of the Netherlands, Maastricht was quite late in doing so (van Leeuwen 1996, pp. 247ff; Cornips 1953, pp. 10–14).

Table 16: Savings and Savers of the Savings Bank of Maastricht, 1853 – 1902

Years	Interests in Gulden	Yearly growth in %	Number of savers (according to the last year of the period)
1853 – 1857	995.83		157
1858 – 1862	5473.13	112.4	367
1863 – 1867	9134.85	16.7	573
1867 – 1872	12009.6	6.3	633
1872 – 1877	21714.1	16.2	1165
1877 – 1882	42491.4	19.1	1749
1882 – 1887	63866.1	10.1	2242
1887 – 1892	73161	2.9	2339
1892 – 1897	82329.5	2.5	2576
1897 – 1902	81127	-0.3	2635

Source: Cornips 1953, p. 52.

Until 1874, the savings bank of Maastricht remained the only savings bank in Limburg for a population of about 230,000. Following the trend of the Netherlands in general, though less successfully, it had 751 depositors in this year (Fokker 1875, p. 680) and 1749 in 1882 (Cornips 1953, pp. 64f). Thus, what Deneweth et al. claim for the Netherlands must also be true for Limburg and Meerssen:

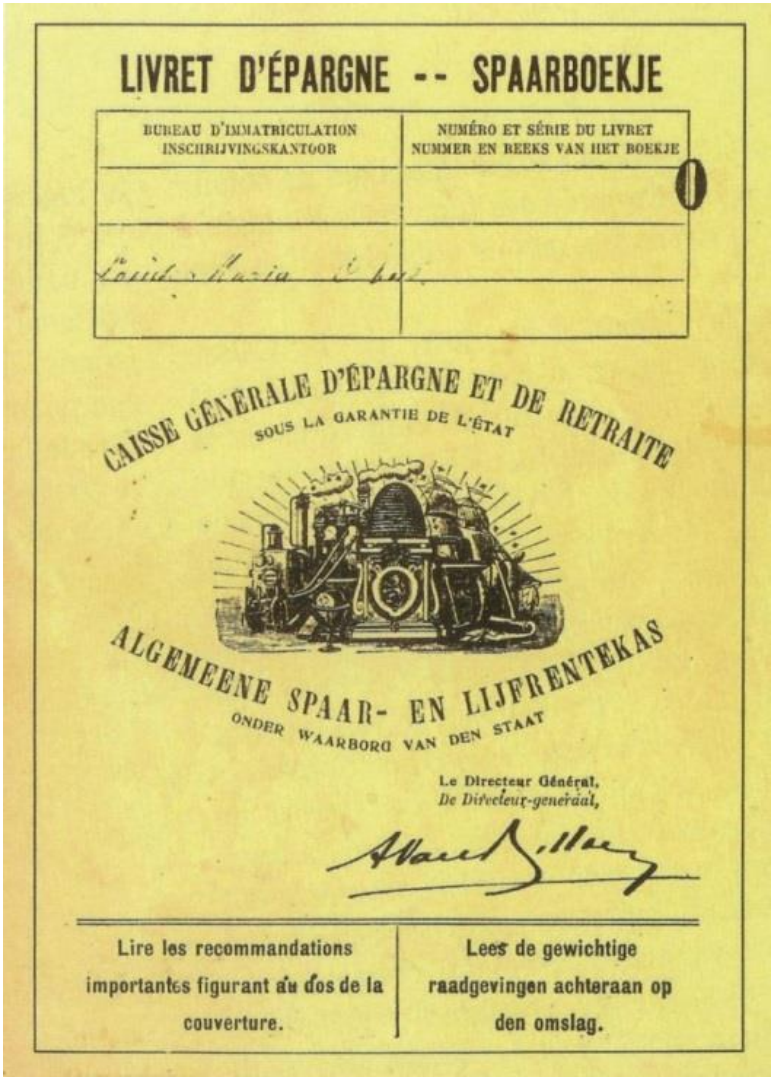
> "[w]e may therefore conclude that savings banks did little to combat poverty in the Netherlands, for two reasons. First, for most of the nineteenth century the banks attracted a fairly narrow customer base, middling groups threatened with downward social mobility. Second, only with rising wages could households start to divert cash away from network circulation to the formal financial market. Once this started to happen during the 1870s the banks, and the government, responded with initiatives to widen the available facilities" (Deneweth et al. 2014, pp. 89f).

In 1881, the Rijkspostspaarbank was established. This banking model would be very successful from the 1890s onwards, and soon outpace other savings banks in terms of clients and turnover. However, as for the Raiffeisen banks in Prussia/Germany, the focus of this study means that its appearance came too late for the research questions addressed here. As for Würselen, the institution in focus remains the savings banks.

The history of Belgian savings banks in the 19th century has to be divided into the history of municipal savings banks and bank´s savings banks: the first municipal savings banks were introduced by the state (at that time, the Kingdom of the Netherlands). The founding of the "Société Générale de Belgique" in 1822, which was supposed to initiate the country-wide opening of savings banks, was a failure. By 1828, only seven savings banks had been established, with a total of only 650 clients in what would later become Belgium. Instead of the local authorities, in 1832, the Société Générale de Belgique itself founded a savings bank of its own. However, founded by a bank itself, its character differed fundamentally from those in Prussia/Germany and in the Netherlands, though a little less so with the latter. The German savings banks were established mainly to reduce poverty, not for profit. The Société Générale de Belgique's savings bank, instead, was "very probably part of a strategy to accumulate financial resources" (Vanthemsche 1996, pp. 28f, quote on p. 29; see also van der Wee 1982). As a result, charity or premium distribution were far from priorities. However, these privately-owned banks had a larger impact than their state-owned counterparts, at least relatively speaking: in 1840, only about 7% of savings banks customers saved their money in municipal savings banks. The other 93% saved in 'private savings banks' (Vanthemsche 1996, p. 30).

In 1835, with the opening of the Banque Liégoise savings bank, the region around Liège got its first savings bank as well - a savings bank of the same type as the Société Générale de Belgique. However, like its forerunners, this was unsuccessful. Only in 1865, with the establishment of the Caisse Générale d´Epargne et de Retraite (CGER), did this situation change: the CGER was founded on the initiative of the liberal minister Orban. Its principal role was to collect, develop, and manage the savings of the general public. Backed by the state, it consisted of two distinct bodies: a savings bank and a pension fund, founded in 1850. The number of account holders with the CGER continued to increase in ever-larger proportions: from under 8,000 in 1888 to about 300,000 in 1900, then to 1.6 million in 1913 (BNP Paribas).

Picture 4: Savings Account Book of the Caisse Générale d'Epargne et de Retraite, circa 1900



Source: BNP Paribas

Though there was a true explosion of banking activities and savings visible at the end of the century, these have to be considered unimportant to relieving economic stress until the very end of the 19th century in Belgium. This assumption is further backed up by Vanthemsche, who finds that, in 1880, not every strata of society was significantly incorporated into the institution of formally institutionalised savings: workers still constituted of only 10% of all the clients, and that was only at the very end of the 19th century (Vanthemsche 1996, p. 32), and does not deal with the unemployed.

A CGER subsidiary opened up in Liège in 1865, another in Verviers in 1869. With a distance of around 35km from Sart to Liège, the developments here had probably no influence at all when following our established proxy for Mindelheim. The only reasonable way for the people of Sart to open an account by the end of the century was at CGER in Verviers. However, as word of success spread, the low figures of workers enrolled in 1880 and the distance of 12.5km to Verviers most probably had only very limited economic stress attenuating capabilities for the people of Sart. For completeness, it should be mentioned that a second branch of privately-owned savings banks came into fashion in the 1840s. An initiative was started by several entrepreneurs to establish savings banks within their factories. However, when reflecting the interests of these entrepreneurs, it is likely that these banks were of a very different character to the German and Dutch banks, and of very limited (or no) success.

We thus have rather clear signs that the savings institutions in Aachen could be a means for the inhabitants of Würselen to overcome economic crises from the early 1830s, that the savings banks of Maastricht supported the Meersseners to a much lower extent from the 1850s onwards, and that the savings banks of Liege/Verviers had, most probably, no significant impact on the people of Sart until the very end of the century.

4.2.2 Borrowing

As previously discussed[45], savings banks evolved mainly through the philanthropic idea of helping people to help themselves navigate crises by enabling them to make savings in advance. Savings and lending possibilities from well-functioning credit institutions were largely undeveloped until the second half of the 19th century in this part of Europe. As shown by Muldrew for early modern England, informal small credits of all sorts were widespread: "[b]oth lending and borrowing were part of the reciprocal obligations of neighbourliness". "[M]asses of informal sales credit", based on trust, ensured "the continued liquidity of such transactions (Muldrew 2001, pp.129, 124). In

[45] The history of credit banks in 4.2.2 now draws on the historical reconstruction of savings banks in general. Their history will not be retold, which is why this part will be considerably shorter than 4.2.1.

Germany, credit giving institutions from the first half of the 19th century were overwhelming private. Private moneylenders were an option for those in financial trouble: following Bracht's reviews of the legal basis for credits and savings accounts, the classic moneylender was often of bourgeois descent or a merchant, and often Jewish. In Prussia, the standard interest rate for credits was 5%, 6% for merchants, and 8% for Jews (Bracht 2013, pp. 154, 211). Here, trust in the debtor's integrity was a key element in the transactions (Bracht 2013, pp. 158f). Further options for borrowing were found in cloisters, charity foundations, or (often Jewish) money-lending merchants, these being the only semi-formalised possibilities for lending before the advent of the savings bank. As people would strive to borrow as cheaply as possible, however, the family most probably remained the first recourse when seeking small or medium-sized loans to overcome short-term economic stress.

Private mortgages were common before savings banks provided them. While creditors were the same as for credit with no security, as documented by Bracht for Borgeln (69.6% bourgeois and merchants), Oberkirchen (33.9% bourgeois and merchants, another 19.7% covered by public servants and farmers), and Löhne (75% bourgeois and merchants),[46] the lending business changed throughout the century. As summarised by Bracht for Denmark and northern Germany, drawing on Poulsen and Meitzen (Poulsen 2004; Meitzen 1866), credit without real estate as security become less common throughout the century (Bracht 2013, p. 159). This also meant that people without property (covering loans and credit with only their reputation) would observe increasing difficulties to finding a creditor.

For the official credit-giving institutions, the first option for obtaining small, formal credit would be a savings bank. However, in Prussia, savings banks traded little in the way of individual credit. From the 1850s to the end of the 19th century, the share of their active business sank from 20% to only 4%. The main reason for this is the less risky mortgage business that these banks shifted their business to (Wehber 2013a, p. 100). As a consequence of these banks neglecting individual credit, cooperative banks stepped in to fill the gap. Aachen's was established in 1876 (ibid; Aachener Bank AG). A partition of the market took place later in the century, allowing the savings banks to focus on lending, supported by the creditor's property, and cooperative banks on short-term lending (ibid.). According to Bracht's figures, savings banks were significant mortgage providers in

[46] Calculated with Bracht´s figures of tables 4-l – 4-n (Bracht 2013, pp. 188, 191, 193).

Westphalia from the mid 1850s onwards (Bracht 2013, p. 201). However, their market share quickly declined again afterwards.

Reviewing land registers, as was done by Bracht, would be beyond the scope of this study. But as the savings bank of Aachen opened only 4 years after that of nearby Soest, we can assume that the institution of credit offered here would also be used significantly from the 1850s onwards, as it was the case for the one Soest. For some strata of society, such as free peasants, formal credit and formally-institutionalised mortgages were a helpful means of overcoming longer negative income fluctuations. Though the possibility of obtaining credit was given from the start of savings bank development (Bracht 2013, p. 202), it must be assumed that an only very limited number of people without assets could actually obtain such credit. Informal lending possibilities of all sorts thus remained the main credit-giving institutions until the end of the century for most people.

In Limburg, the development of institutions providing credit to the middle strata of society was quite similar to the Prussian Rhine Province. Banks' interest rates for credit ranged from 4 – 4.5%, and like in Prussia, Dutch savings banks did not give credit to the landless poor and/or middle class until the late 19th century. Therefore, and especially in Limburg, informal loans from notaries, family, friends etc. remained the main credit-obtaining institutions throughout the 19th century (Cornips 1953, pp. 64f). This situation ameliorated little, and only after the crisis of 1845 – 1847, when Maastricht's credit bank and the general idea of helping people to help themselves became more successful (Jansen 1986, p. 544).

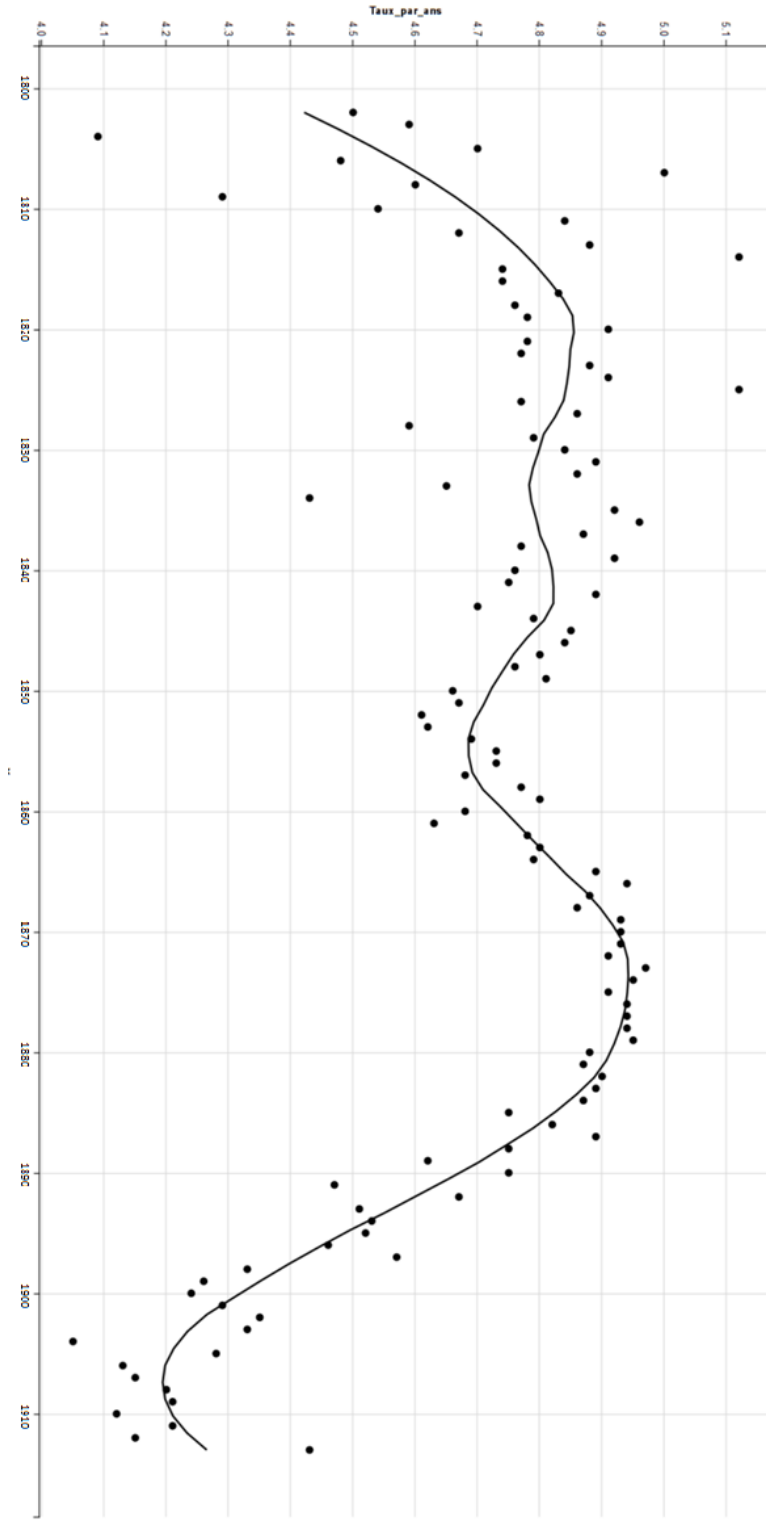
The institution of mortgage at the Spaarbank of Maastricht was established in 1874. From there on, small mortgages of 15 – 20 Guldens could be obtained, as well as a maximum amount of 75% of a building's value, not exceeding 25,000 Guldens. The interest rate of 4.5% on the mortgage was fixed throughout the century (Cornips 1953, pp. 64ff). However, the same logic of availability for the poorer strata applied here. For individuals that did not possess property, land or real estate, mortgages were by definition unobtainable. The poor were once more left without options for attenuating economic stress.

In Belgium, private credit was important long into the second half of the 19th century. With the province of Louvain as an example, Têcheur (Têcheur 1957) analysed the Belgian mortgage market through mortgage registers (fr.: "Conservation des Hypothèques") and mortgage data, provided by the credit-giving banks themselves, from 1802-1954. According to his figures, the earliest formally institutionalised mortgages were provided by the CGER from 1869/1874 onwards

(Têcheur 1957, pp. 109, 135ff). Additional players began to enter the market in 1881 (Caisse Hypothécaire Anversoise, Banque Hypothécaire Belge, Caisse Hypothécaire d´Ostende, Caisse Hypothécaire), with the CGER remaining the most important nationally. Initially, the CGER only allowed credit to those with land. What has already been identified for the lower strata in general thus applies here too: they are, again, left out of the credit business. In the 1880s the CGER began to diversify its activities, and agreed to cheaper credit for peasants through the pressure from the influx of American grain, easing the constraints for granting credits somewhat. From 1889, it was also able to grant cheap loans with an interest rate of 2.5% to workers willing to purchase their homes (BNP Paribas 2017; Banque Publique). In summary, small credit from Belgian banks was most possibly the hardest to get for the lower middle class in the three communes, and this does still not take into account the poor who would have needed them most and obtained them least.

An example of the average annual mortgage interest rates from the Province of Liège's neighbouring Arrondissement of Louvain is given below by Têcheur (Têcheur 1957), who reconstructed a time series for the 19th century from this data:

Figure 14: Average Mortgage Interest Rates in the Province of Louvain, 1800 – 1900



Trend: Loess Regression with span = 0.75
Source: Têcheur 1957, appendix

The yearly average interest rate of mortgages in the Province of Louvain increased around half a percent from the beginning of the century until the 1830s, and fluctuated strongly until about 1840, with a level sometimes over 5% per annum. After a short lower-level phase in the 1850s, the rate reached its steady peak in the early 1870s. A steady decline set in during the mid 1870s, coinciding with the influx of American grain, which continued until the end of the century, resulting in a decline of almost 1% per annum from the 1870s peak. However, the fact that there was always the possibility to obtain mortgages alone did not suffice for securing economic attenuation during hard times. Obtaining mortgages remained a privilege for the landed gentry, and had little influence on the rest of society. With this time series, it will be possible to also measure this in the statistical part.

Pawn shops

Sometimes officially supported, sometimes private, pawn shops might have been a more suitable means for attenuating short term economic stress for the lower strata of society.

For Aachen, there were no official pawn shops in 1890 (Braun et al. 2012[1900], p. 62), and thus no public pawn shop started by state authorities. Also, there is no indication of a pawn broker or pawn shop in the data for Würselen, as no "Pfandleiher" or similar could be detected in the information on occupation. However, it is also known that many of the small number of Jews (about 100 in 1820) in Aachen made a living from pawn shops and small money lending (Dresemann in: Braun et al. 2012[1900], p. 23). Thus, for Aachen, it is very likely that there was the possibility of relying on private pawn shops in difficult times, at least for the first half of the century.

Oberndorff and Niesten found a pawn shop owner in the Meerssen population in 1840 (Oberndorff and Niesten 1994, pp. 170f), clearly indicating both the existence of a professional pawn shop in Meerssen and that its services were used to an extent that its owner could make a living from it. Maastricht also had an official pawnshop which was important during the first half of the century (Jansen 1986, p. 544).

The official public pawn shop in Verviers was reopened in 1806 by the French government, with an interest rate of 7-15% on items brought in by customers (de Decker 1844, p. 315). According to de Decker, about 4,500 articles were brought into the pawn shop each year from 1822 to 1830

(de Decker 1844, p. 318). This shop must have been quite important for Verviers and its surroundings at the time.

For the three communes of Würselen, Meerssen, and Sart, it can be said that there were rather equal opportunities for using pawn shops in the first half of the 19th century (probably best in Meerssen). However, as the interest rates for Verviers show, this option remained a very expensive one that was likely avoided where possible. Of course, pawn shops were not an option for those who had nothing to trade: these people had to hope for poor relief.

4.2.3 Poor Relief

Public Poor Relief

The life of the poor at the onset of the industrial revolution is comparable only to those of the poorer quarters of today's third world countries. Malnutrition was constant (Haesenne-Peremans 1981, pp. 248, 385f). In pre-industrial Germany, poor relief was a state matter in Germany, without neglecting the role of cities and the church (Sachsse and Tennstedt 1980, chapter C.). In the Southern Netherlands (essentially Belgium at this time), poor relief was to a large extent financed from public funds as well, while church funds played a much bigger role in the rest of the country (Grell et al. 2002, p. 262). The revolution, with the enacting of the French Law, contributed to an overall convergence in poor relief organisation. Particularly important in its consequences was the separation of church and state (Jappe Alberts 1974, p. 117). In the French period, poor relief responsibility shifted further away from the church and became a state issue by law, complemented by private, voluntary action, including the church. The state's greater obligation to care for the poor resulted in the opening of hospices, welfare offices, hospitals, and begging houses (Graumann 2019).

In the becoming district of Aachen, the poor-relief system was restructured during the French period and communally organised. Under Prussian rule, it was concentrated in the Commission on Poverty Administration (german: Armenverwaltungskommission). Though being independend by law its connection to the municipality of the city was actually interwoven both personally and financially. In 1823, about 14% of the entire population had to be supported. The poor received

free health care but material support was meagre: next to the nutrition necessary to survive (0.84kg of bread per week), little else was done. The needy additionally received 9 Pfennige per person per week and some coal or wood during winter. Still, when compared to other German cities, the poor in the city of Aachen had a rather well-developed poor relief system in the 1820s. With rye constituting the main basis for nutrition, especially during the first half of the 19th century, during hard times, the city's administration (in cooperation with the Poverty Administration) acquired large amounts of grain to smooth out quickly rising food prices. This was especially true during crisis years, such as 1800, 1831, the late 1840s and the early 1850s. In such years, the Prussian central state would usually devote a considerable amount of money to poor relief in its affected communities (Althammer 2002, pp. 292f, 422). The following table shows this for Aachen.

Table 17: Municipal and State Expenses for Poverty Administration in the City of Aachen, 1846 – 1876

Year/Level	**1846**	**1852**	**1861**	**1867**	**1876**
From the municipality	27028	40003	43281	35932	83329
Total (including the state)	71012	81143	94616	104480	201444
per capita	1.5	1.6	1.6	1.6	2.5
Poor Households	ca. 1600	1601	1375	1326	1640
Silvergramms per Family per week		6.8	6.6	7.6	11.4

Source: Althammer 2002, p. 431

The share of the total poor relief budget spent by the state varied from about a half (in 1852) to two thirds (1846 and 1867), indicating strong financial back-up from the communal government. The table also shows that per-capita expenses did not grow until 1876, while a slow decline in poverty is expected to have set in during the 1860s. With a declining number of poor households and the city growing at the same time, the logical consequence was an overall growth in wealth. From the late 1870s, both the amount of poor relief spent on poverty administration significantly increased on both levels per capita, as well as per family. Thus, though the number of poor households increased again, the figures indicate that these households were sufficiently taken care of, and could cope with short term crises.

In Würselen, according to the new French Laws from the beginning of the 19th century, the first provider of poor relief was the commune itself. Considerable amounts of money were given to the poor in times of crisis, sometimes supported directly by donations from the King of Prussia (such as in 1834 and 1846). Despite growing efforts on the part of the Prussian state later in the century, private, voluntary action remained a major poor relief provider in 19th century Würselen too. Miners' and metalworkers' associations and the church voluntary contributed to the poor relief available (The Mayor's Chronicles, author's own material).

Limburg had a relatively well-developed poor relief system from early on: after the French occupation, the church remained a major player in providing for the sick. Especially in Limburg, many Catholic institutions (such as monasteries) provided help. Catholics from all over the country would bring their needy here because of the network and low prices (Rutten 1995, p. 126). Despite efforts from the church, however, "in Maastricht […] it was primarily the civil poor administration (Burgerlijk Armbestuur) which provided assistance" (Grell et al. 2002, p. 267). As a result of these two institutions operating simultaneously, according to Grell et al., the share of public poor relief in Maastricht was much larger than in most other Dutch cities (Grell et al. 2002, pp. 266ff, see also Gales et al. 1997).

In 1817, in the parish of Ulestraten (a parish to the north of the municipality of Meerssen), 17% of its population were considered poor. Poverty was certainly an issue in the region and in the commune of Meerssen at this time. In the same year, local authorities in Ulestraten set up a poor support system, separating the poor into three classes and providing them with food (and some money), according to their class. Meerssen must have had a very similar system at this time, as the following indices show: in 1822, the Dutch King passed a law establishing a "Charity Office" (in Dutch: Bureau van weldadigheid) in each parish of the country. Furthermore, a law of 1818 forced the municipality to pay a living for beggars who lived for more than four years in the municipality or who have been born here. In 1836, Meerssen received subsidies to deal better with this problem (Oberndorff and Niesten 1994, pp. 184, 196). A "poor doctor" (dutch: armenarts) was assigned to treat patients that could not afford proper medical treatment, and 20 Francs were spent on education for poor children yearly (ibid.). After the Belgian revolution hardship increased once more, and in 1843 Meerssen decided to open up its gates to the needy. Since then, their numbers increased strongly. When the poor could prove that they were needy to the Charity Office, 'first aid' could be given (ibid.).

However, the initiative to diminish the number of needy and to prevent begging in 1861 shows that poverty remained an issue in Meerssen until at least the second half of the century. The poorer Dutch also helped themselves with sickness and funeral insurance: in 1850, about one fourth of the Dutch population had funeral insurance, increasing to 50% by the end of the century. Another 10% had sickness insurance in the last decade of the century (van Leeuwen 2000, p. 61). However, only after the 1850s could insurance companies further expand towards poorer segments of society. With a majority of clients paying 0.035 cents per week, the poor could afford such insurance (Deneweth et al. 2014, pp. 91ff), and help themselves out of misery in the middle or long term.

Similarly to the other two districts and communes, in Belgium, poor relief was organised locally. Archive work reveals the first accounts of the welfare office (french: bureau de bienfaisance) for Sart in 1828. The following table shows the poor relief offices' accounts from 1828-1887.

Table 18: Accounts of the Welfare Office for the Commune of Sart, 1828 – 1887

Year	Receipts	Expenditures	Yearly Expenditure Growth in %	Result
1828	899.0	707.1	-	191.9
1832	684.6	666.7	-1.4	17.9
1837	-	-	-	-
1842	2089.7	2014.8	20.2	74.9
1847	2498.2	2339.5	1.6	158.7
1852	1126.6	795.2	-6.6	331.4
1857	1342.4	1061.6	3.4	280.8
1862	1433.6	737.2	-3.1	696.3
1867	836.5	812.1	1.0	24.5
1872	1670.7	1254.5	5.4	416.2
1877	2358.5	1618.7	2.9	739.8
1882	2267.7	968.8	-4.0	1298.9
1887	1849.5	1088.2	1.2	761.4

Source: Belgian State Archive in Liège, author's own material

The welfare office in Sart was mainly financed by the commune itself. The receipts were municipal funding, subsidies from land tenures and rents, and money went to the needy. Two findings from Table 18 are striking: that the poor relief office achieved a positive result throughout the period, and the volatility of the growth in expenditure. Both are explained by the community's strong self-financing obligation. Unlike in Würselen and Meerssen, the receipts, more than the severeness of the recurring short-term economic downturns and existing poverty, determined the levels of welfare expenditure. This is further strengthened by comparing the figures from Table 18 with the number of abandoned children in the commune of Sart in 1828-1887 from Table 19:

Table 19: Communal Accounts, Communal Welfare Expenses and Abandoned Children in the Commune of Sart, 1828 – 1887

Year	Communal Accounts	Yearly Growth of Accounts in %	Expenses of the Communal Welfare Office	Yearly Expenditure Growth in %	Abandoned Children
1839	2985.0	-	-	-	5
1842	3406.2	4.7	2014.8	-	4
1847	3237.4	-1.0	2339.5	1.6	10
1852	3225.8	-0.1	795.2	-6.6	3
1857	2176.7	-6.5	1061.6	3.4	2
1862	18508.5	150.1	737.2	-3.1	1
1867	17508.4	-1.1	812.1	1.0	1
1872	32680.7	17.3	1254.5	5.4	1
1877	26330.5	-3.9	1618.7	2.9	2
1882	22721.3	-2.7	1207.4	-4.0	-
1887	24763.3	1.8	945.6	1.2	3

*This large increase in communal accounts is explained through the privatisation of communal forest land, which occurred in batches from the 1860s to the 1880s
Source: Belgian State Archive in Liège, author's own material

In 1847, with the final year of the last food crisis of the 'old type' in the region, the highest number of abandoned children was found. At the same time, the nominal expenditure on poor relief was the highest that was accounted for. Still, even during these years of hunger and starvation, the balance of the poor relief office allowed for a positive budget of 158.7 Belgian Francs (not shown

in the table). When compared to Aachen, the money spent on the education of poor children in the early decades of the century, which was sometimes 0 and sometimes 8 Francs (ibid., not shown in the table), the conclusion is that poor relief in Sart was rudimentary at best.

For all three communes, though somewhat more pronounced in Würselen and Meerssen, it can be stated that poor relief had an economic stress-attenuating effect for *some* individual. But poor relief helped those who had already slipped into a bad (or even dramatic) situation. These people were brought into a situation in which they would be able to survive with 'a little help' (van Leeuwen 1993), but it is hard to imagine that these rudimentary poor relief systems could really help in building up marriage funds. Modern social security systems may have this potential, instead.

Social Security

After the unification of Germany, major changes in social security occurred. Here, a comprehensive modern social security system was introduced almost two decades before the Province of Liège, and almost three decades before it was introduced in Dutch Limburg. Table 20 provides a summary of the most important social security laws for the three states of the Border Triangle:

Table 20: Most Important Labour and Social Laws in Prussia, Belgium and the Netherlands from the French Revolution to the End of the 19th Century

Timeline	Prussia	Belgium	Netherlands
1800			
1810		1813: Imperial decree for invalid and survival pension (miners); 1818: Support for beggars	1818: Support for beggars
1820		1822: Imperial law for the establishment of communal Charity Offices	1822: Imperial law for the establishment of communal Charity Offices
1830			
1840	1842 - 1843: Revision of the Prussian Poor Law		
1850	(1853: Elberfeld System)		1854: Introduction of the Poor Law
1860			
1870	1871: Employer liability law; 1878: Reform of industrial law: Maternity protection, ban of child labour*		1874: Ban of child labour
1880	1883: Health insurance; 1884: accident insurance; 1889: pension insurance**	1889: Labour Law: protection of women and child labour ban	1889: Labour Law: protection of women and refined ban on child labour
1890		1894: Poor Law, health insurance; 1895: Pension Law; 1896: law for the protection of wages	
1900		1903: Law on accidents at work	1901: Employer liability law; health insurance
1910		1911: Pension insurance	1911-13: Reform of labour law: reduction of working time, sickness law; reform of Poor Law 1912

*a child is defined here as an individual younger than 12

Sources: Frohman 2008; Deimling 2002; van der Linde 2016; Hoogenboom 2004; de Swaan and Hendriks 2004; Fierens 2012; Sachsse and Tennstedt 1980; Krabbe 1989

The first of these important social security laws was enacted early in the century, in the department of Ourthe in 1813. After a series of accidents in the mines that year, a security fund was established by imperial decree. It was funded by both employees and employers, and paid a pension to those who had become unable or too old to work. The miners could now rely on an invalidity and survival pension in case of a disaster. This important step was only locally introduced, and remained locally applied in the department of Ourthe until the end of the century. Furthermore, only miners could profit from the decree. A second, constantly struggling group were beggars. They were officially supported from 1818 onwards throughout the entire United Kingdom of the Netherlands.

Then, as mentioned above, another early step towards comprehensive social security was an imperial law for the establishment of communal charity offices. However, though now geographically distributed throughout the entire United Kingdom of the Netherlands, these measures provided only a rudimentary amount of help, as shown above.

The years 1842 – 1843 brought about the first steps towards a state-organised nationwide modern social security system in Prussia. The Poor Law Revision in Prussia granted the provision of the minimum required for existence to the poor through the state-wide local implementation of poor law unions. As detailed for Aachen, these poor law unions had a local budget and were also supported by the state (Althammer 2002, pp. 292f, 422).

The 1850s had an increase in new measures to overcome the most severe poverty. One could say here that the situation had to get especially bad before it could get better: causing necessary adaptive actions (Krämer 2012, pp. 59f) that finally improved the situation. This new-found awareness of poverty led to the spread of the Elberfeld System in Prussia and to the Poor Law in the Netherlands.

a) The Elberfeld System first was a system of decentralised poor relief in a part of what is now the city of Wuppertal. Its function was dependent on territorial differentiation (districts) and volunteers (Krabbe 1989, p. 101). It was later adopted by many other cities, and certainly ameliorated the life of the poor. A one-to-one adaptation into the poor relief system of Aachen or Würselen, however, could not be observed.
b) The first poor law to address all of the Netherlands' poor was a nationwide one. However, the regulation was such that this poor relief would only come into play if all other means failed, such as relief from the church or private institutions (Wintle

2000, p. 49). It was still only a rudimentary addition to the existing poor relief institutions of Meerssen that were detailed above.

From the 1870s, Prussia led the way. The reason for Bismarck's initiatives are widely known (see Ullrich 2014, p. 71f, and for a more detailed account see Tennstedt 2017; Borgmeyer 1994): the growing power of the Social Democrats in the 1870s and 1880s, a result of poverty and great industrialisation, put him under pressure in Prussia.

In 1871, the employer liability law came into effect, making employers pay for damages at work, not the worker. This law was followed by the reform of the Industrial Law in 1878, which introduced maternity protection and banned child labour. When compared to the other two countries under investigation, these measures can be considered quite early. Though the Kingdom of the Netherlands had passed a Law which banned child labour earlier than Prussia, there was little checking on the implementation of its regulations. As a consequence, loopholes could be found and child labour could not be entirely prevented (White 1994, p. 19).

The 1880s changed the settings for Imperial Germany entirely. The Bismarckian Social Laws formed the first comprehensive modern social security and welfare system. By the end of this decade, both Belgium and the Netherlands passed Labour Laws which would ensure the protection of women and ban child labour completely, with the Dutch case including effective controls (White 1994, pp. 20f).

The most decisive decade for Belgium was the 1890s, when the Poor Law, health insurance, a pension law and a law for the protection of wages were introduced, forming (together with the 1903 law on accidents at work) a modern and comprehensive social security and welfare system for Belgium.

The Netherlands stand out in this development, as a large part of their labour and social laws were only introduced after the turn of the century. After 1910, the level of the welfare state the Prussians had formed around a generation earlier was reached. The Netherlands also stand out as some important laws were enacted very early, others very late. The Dutch authorities seemed to act more continuously, with poor relief and social security systems under constant revision, indicating more flexible institutions on the whole. Instead of introducing an all-encompassing modern social security system in only 18 years, as the Prussian/German authorities did, the more liberal Dutch authorities follow a more adaptive strategy that allowed them to react to the acute poverty problems of the time. The demand for self-help can be considered more pronounced in the Netherlands than

in the other two countries: the contrast between often privately arranged insurance in the Netherlands and early state insurance in Germany and Belgium are examples.

The most favourable environment for the poor in the first two thirds of the century is thus found in Meerssen, because of its voluntary poor relief organisations (including the church) and laws. After German reunification, however, Würselen took over as the best provider of social security among the three communes. The people of Sart, until the very end of the century, were left more on their own when it came to coping with short-term economic stress. As indicated above, the adjustment in labour supply could have been another means of doing exactly this.

4.2.4 Adjust Labour Supply

Under French rule, very liberal labour markets emerged in the Border Triangle at the beginning of the 19th century. The abolition of guilds and the manorial system, the liberation of the peasants who were still unfree and early factory production set many workers free, both from farming and home craft production. With the end of the Continental System, right after the French left the Border Triangle, English textiles, followed by English textile machinery, flooded the market and resulted in lower real wages for the textile industry in the area (Jappe Alberts 1974, pp. 177ff). With the constant influx of migrants from the countryside searching for opportunities in the emerging industrial centres, the workforce was abundant and therefore cheap. Working conditions in this period were terrible. Emil Zola's novel 'Germinal' is probably the most realistic account of how coalminers lived until the middle of the century: six working days per week, working days of 12-14 hours, night shifts of the same length, humidity, noise, difficult breathing, deadly work accidents, tuberculosis, alcoholism, psychological pressure, and tiny dwellings inhabited by too many people (for a purely scientific description see Desama 2013, p. 5). The average salary of a male day labourer in 1843 Verviers (1.5 – 2 Francs per month, and half this amount for women) and the cost of living (the average rent was about 3-6 Francs per month and a loaf of bread was 0.2 Francs) might make readers today puzzled as to how these people were able to survive at all (ibid.).

Miners in the district of Aachen often remained partly in agriculture or smallholding, and complemented their income by working in mines when the harvest was done. During harvest time, they were supplemented by temporary migrant labourers from nearby regions and, if necessary, commuters or migrants from Limburg or Belgium. "Around 1830, some hundred Belgian migrant workers worked in the cloth factories and machinery industry; they had industrial experience and they were easily disposable, as they would be sent back home if there was no work" (Reckendrees 2014, p. 15).

The life of coalminers and textile workers improved very slowly. The liberal Ricardian school of thought shaped an ideology of the early entrepreneurs in Verviers which allowed for nothing more than paying a 'natural wage' (Ricardo 2011[1817]), aiming at nothing more than letting workers earn enough to survive and have enough physical strength to stay fit enough for productive working. Even though the productivity rose by about 17% in Verviers between 1850 and 1880, purchasing power remained more or less stable (Desama 2013, p. 5). A constant "armee de reserve" (Desama 2013, p. 3)[47] of commuters and migrants (about 10% Germans) kept work force supply higher than demand. Only at the very end of the century, through the enactment of the social security laws seen above, did the situation really improve.

According to Reckendrees, the situation was somewhat better in the Aachen area. This was not only through the relatively early Bismarckian social laws, but also with an increase in industrial production (especially in the 1850). The labour market underwent a pronounced change, providing better conditions for the workers earlier than in Verviers and its surroundings:

> "Wage data indicating the change in the labour market is spurious, yet adaptive company policies allow the conclusion of emerging labour markets. For example, when the Wurm mines in 1839 established a health and accident insurance (Knappschaft) like the one the neighbouring Inde mines had introduced three decades before, the Inde mines started providing housing for workers. They were not only competing with the other coal mines […], but also with the new zinc and steel plants established on top of the coal and with the Rhenish railway looking for construction workers.
>
> The woollen cloth industry, in which many young women were occupied, was for example challenged by newly set-up tobacco manufactories offering less exhausting and relatively well paid work to girls and young women. The reports of the chambers of commerce for the 1850s inform about rising wages and wage competition, yet not about the wage levels." (Reckendrees 2014, p. 15).

[47] The original term "Industrielle Reservearmee" (reserve army of labour) was established by Marx in "Das Kapital" Marx 2017 [1867].

Maastricht itself had no zinc and steel plants or coal mines to offer, though work in the factories was probably as life-threatening as in the coal-fields: 16 hours of work per day were not unusual in the very early period of industrialisation, when the machines themselves dictated the pace. According to Roozendahl, 20 hours shifts were not unheard of. While these shifts were gradually reduced over the next hundred years, only the reform of the Labour Law in 1911 brought about a legal maximum of ten hours of work per day. In 1919, the 45-hour work week was established in the Netherlands (Roozendaal 2011, pp. 25, 32f).

In terms of working hours, the situation was equally difficult for the Belgians. Belgium was a haven of liberalism, hostile towards any kind of state intervention, and a survey by the Belgian Ministry of the Interior revealed the conditions of the labouring classes in 1843: a 72-hour week was the norm in the early phase of industrialisation (Royaume de Belgique, Ministère de l´intérieure 1848, t. I, p. III), and this continued until the end of the century. Further reductions in working hours in the mining sector came only after the turn of the century (in 1909) (Vanvelthem 2016, pp. 4f).

The situation for the Prussians was a little better: from an almost unimaginable 82-hour working week in 1825, the maximum number of hours per week was limited to 72 in 1875, 15 years earlier than the Belgians. 25 years later, and 11 years earlier than the Dutch, the 60-hour week was implemented (Strawe 1994).

Another important factor of the labour markets in the region was female participation in it and life-cycle servanthood, as detailed in 2.2. Alter, Neven, and Oris find a surprisingly low share of households with a servant: 1-2.4% in eastern Belgium (Alter et al. 2004c, p. 196), indicating that this typical nuclear family system feature was not very important (Hajnal 1982). For the mines in Liège and the textile industry in Verviers, females made up a considerable portion of the workforce. “In Belgium, women do all the work” […] is the provocative title of an article by Roels (Roels 2008) on female labour in Belgium. However, according to her own figures, this statement has to be refuted, as shown in the following table:

Table 21: Male and Female Labour Market Participation in the Mines of Belgium and Liège, 1846 – 1896

Year	Miners	Belgium	%	Liège	%
1846	Men	39120	84.7	10191	86.9
	Women	7066	15.3	1535	13.1
	Total	46186	100.0	11726	100.0
1880	Men	83022	87.6	20583	92.3
	Women	11735	12.4	1722	7.7
	Total	94757	100.0	22305	100.0
1896	Men	106812	92.2	28034	93.8
	Women	8981	7.8	1847	6.2
	Total	115793	100.0	29881	100.0

Source: Roels 2008, p. 55

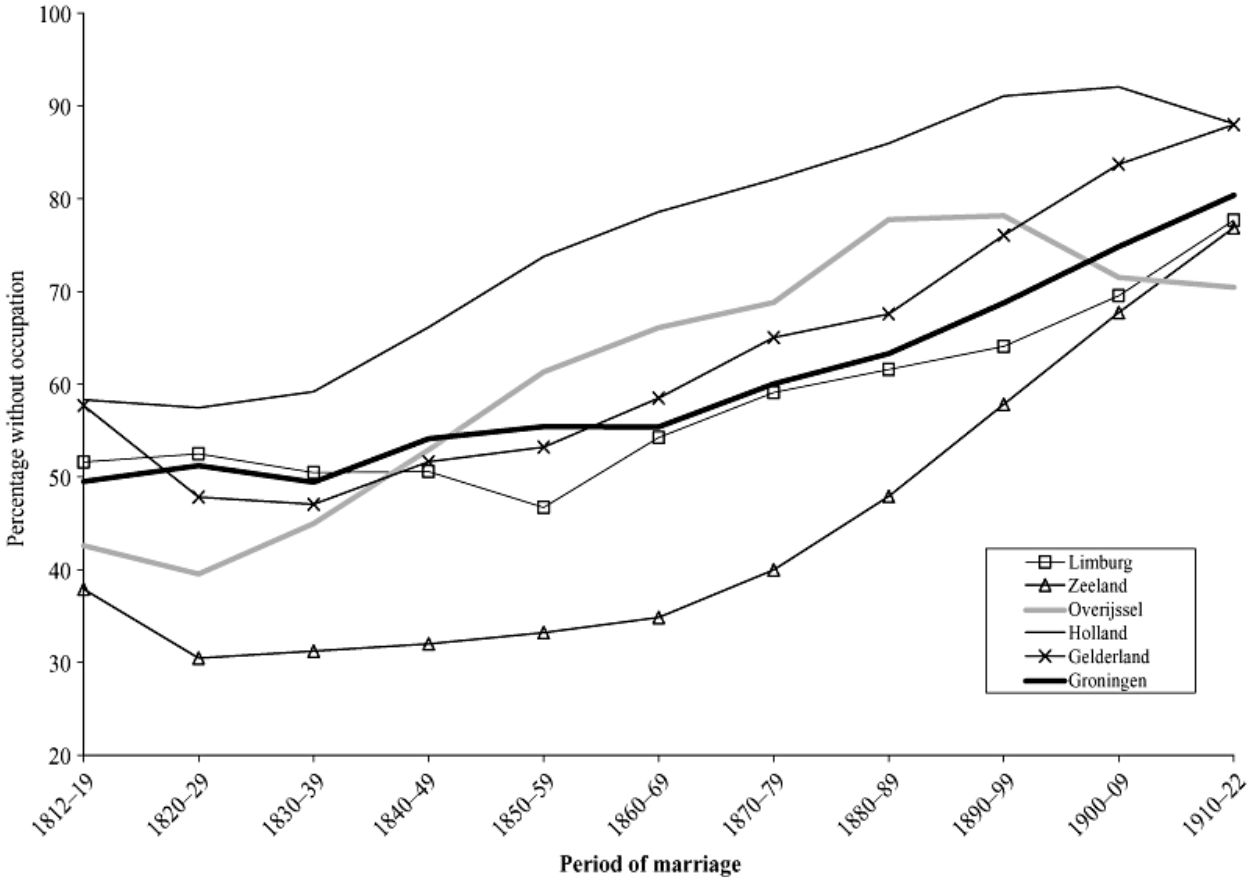
With a share of 13% in 1846, female labour in the mines of Liège was considerable but not as large as Roels' title infers. Furthermore, these statistics hide the fact that this female labour market participation is mostly sporadic (Hilden 1991, p. 161) or of a life cycle character (Roels 2008, p. 70). This share of about 13% further decreased throughout the second half of the century until, from 1892, female labour market participation in the mines was completely forbidden by law in Belgium.

In Germany, the share of women participating in the labour market was lower than in Belgium (Roels 2008, pp. 75, 80f), and only a small percentage worked in mining or heavy industry. However, as in Belgium, female labour market participation was a common and widespread phenomenon in the textile industry (Heintz and Honegger 1981, p. 20). According to Kaelble and Hohls, the District of Aachen was 2.1% lower than the German average for the share of women participating in the labour market in 1895 (Kaelble and Hohls 1989, p. 367). Bearing in mind that, as with Belgium, female labour market participation probably declined throughout the century, it can be expected that female participation in the labour market was generally higher in the middle of the 19th century than at the end, though not for mining. Also comparable to Belgium was the life-cycle character of women´s participation in the labour market: most women worked from their early teens until marriage, and a shift from women working in small home craft production to

women working as servants in the bourgeois households took place: from 1840 to 1914, 70% of the bourgeois households of Budde's sample of 350 German households had female servants, 33% of them more than 1 (Budde 1994, p. 276).

As shown in Figure 15, female labour market participation in Limburg was, with the exception of Zeeland, highest in the Netherlands from the mid-19th century onwards:

Figure 15: Female Labour Market Participation in the Netherlands per Marriage Cohort, 1812 – 1922



Source: van Poppel et al. 2009, p 113.

The y axis shows the percentage of women without a formal occupation, the x-axis their marriage cohort. Figure 15 includes mainly young, recently-married women, underestimating the true share of all unemployed women. Still, an overall decline in female labour market participation in the Netherlands and Limburg is apparent, and with it a strengthening of the male-as-breadwinner system, fitting well into mainstream sociological theory (see Tilly and Scott, 2013). However, both

life-cycle servanthood and female labour market participation remained common in the Netherlands and in Limburg, according to the figure above.

Further elaborating the character of the labour markets in the three communes, the following table shows the number of miners in the 4 pits closest to Würselen, and an estimated share of the population fed by miners in Bardenberg (a part of the commune of Würselen) and Würselen (core) from 1803 to 1914:

Table 22: Number of Miners in Bardenberg and Würselen (core), 1803 – 1914

Year	Number of Miners	Share of Population Fed by Miners
1803	580	18.6
1831	375	9.5
1860	593	12.8
1890	1298	19.5
1914	1200	11.1

Source: Zapp 1995, p. 306

The table shows that mining was indeed central in the lives of the people from Bardenberg and Würselen. In the 19th century, almost 20% of their inhabitants were nourished by incomes of miners. However, according to Zapp, the share of Würselen's population fed by miners was probably much smaller than Bardenberg, probably never passing 10%. Instead, from the early industrialisation phase onwards, most of the workforce were employed in factories. In 1834, 30% of the population were fed through factories, 20% by agriculture, 10% by "home" mine-work (meaning work in coal pits close to home), 4.3 % by small craftsmen, and 3.2% by servants. This 67.5% constitutes little over 2/3 of the population. The remaining 32.5% is made up of about 15% migrant miners, who had to commute to places other than the Wurm coal fields. The remaining 17.5% is non-assignable, and were probably fed by poor relief (ibid.). This picture shifts during the time of rather strong population growth, with which the economic growth could not keep pace. During the 1860s and 1870s, more mineworkers were forced to commute until, during the 1880s and 1890s, double the number of jobs were available through the enlargement of existing coal-

mines (ibid.). Though the Wurm coal fields were very close, probably because of its weak caking coal, these home-fields were never more decisive in contributing to the nourishment of the population than agriculture, even in times of relatively high coal-exploitation (Zapp 1995, pp. 304f, 315).

The number of miners rose constantly through the century: the newly-appointed mayor of Würselen was unable to establish a militia in Würselen during the troubles of 1848 because the majority of the population consisted of factory and mine-workers, who were away from their homes for most of the day. About eight years later, the growing number of workers in Würselen led the local authorities to induce an entrance fee of 10 Talers for all those who wanted to migrate to or live in Würselen. In 1867, the commune's analyst remarked that the number of workers has been rising constantly in recent years (Liebenwein 1995, pp. 101ff). In general, coal mining was probably much more important for the people of Würselen than Zapp's figures infer.

The following table draws on demographic data from the Familienbuch Euregio. It shows a comprehensive summary of the social classes in Würselen, classified via the individuals' occupations on the Hisclass 5 system. This information is provided through marriage certificates. The measurement of occupations took place at the time of marriage for each individual, not taking into account later personal improvements or achievements.

Table 23: The Social Strata of Würselen, 1810 – 1900

	Men		**Women**	
		Share of working		**Share of working**
Social Strata	**n**	**population in %**	**n**	**population in %**
Elite	32	0,45	4	0,04
Lower Middle Class	133	1,81	13	0,18
Self-employed, Skilled	1452	19,77	212	2,88
Farmers	178	2,43	7	0,09
Low/ Unskilled	878	11,95	262	3,57
N/A	972	13,23	3202	43,59
Sum	3645	49,7	3700	50,3
Total Working Population	7345			
Total Working Population in Percent	100			

Source: Familienbuch Euregio, own calculations

From this perspective, Würselen can be best described as a conglomerate of (skilled and unskilled) workers: in fact, 91.17% of the known occupations were workers (see Table 26), complemented

by relatively few farmers, a small (mostly white-collar) lower middle class and a very small elite, the latter two making an upper class that was 2.5% of the population and 4.79% of the classifiable population (see Table 26). There is no information about the occupation of 13.23% of the men, 43.59 % of the women. There are many reasons for information on occupations to be missing in historical data: the share of men could point to a considerable share of unskilled labourers without information on occupation in the sample, such as day labourers or farm hands. The large share of women without registered occupations is instead due to the structure of the source material. The information on occupations in the Familienbuch Euregio is often derived from Würselen's church marriage books (see Table 41). It was common practice for priests to only enter the occupation of the husband.[48] It might be that the higher the status of the husband, the less the woman participated in the labour market (due to a lack of need). This would mean that the NA group generally contained a larger share of unskilled men and a larger share of elite, upper-middle class women and perhaps the wives of self-employed skilled workers (and possibly also farmers, as the husband usually counted for the entire household). The small elite, both for men and women, likely points to a small number of female servants inside the commune throughout the century. Female servants would mainly work in upper or upper-middle class households (Heintz and Honegger 1981, pp. 20f), as indicated above. However, the nearby city of Aachen surely provided more opportunities for young women to find such life-cycle jobs. Table 24 indicates the social strata of 19th century Meerssen at the point of marriage.

[48] See the example of Johann Martin Weber and his bride Johanna Maria Meessen: http://www.familienbuch-euregio.eu/genius/?person=93469.

Table 24: The Social Strata of Meerssen in the 19th Century, 1810 – 1899

	Men		Women	
		Share of working		Share of working
Social Strata	**n**	**population in %**	**n**	**population in %**
Elite	48	1,26	3	0,08
Lower Middle Class	92	2,41	34	0,9
Self-employed, Skilled	389	10,22	58	1,52
Farmers	172	4,52	14	0,37
Low/ Unskilled	730	19,16	573	15,06
N/A	519	13,61	1176	30,89
Sum	1950	51,2	1858	48,8
Total Working Population	3808			
Total Working Population in Percent	100			

Source: Familienbuch Euregio, own calculations

With about 46% of the entire population (including NAs), skilled and unskilled workers were by far the majority. Compared to Würselen, however, the workers of Meerssen were considerably less skilled. There was also a somewhat larger elite, pointing to a higher share of life cycle servanthood opportunities for young women in Meerssen and a larger percentage of farmers. While NA cases for men were almost equal to those of Würselen, there were lower NA shares for women. These NA groups most probably contained a larger share of unskilled men and a larger share of elite, upper-middle class, self-employed skilled workers and farmers for women, for the same reasons detailed above.

According to former studies, Sart's ecotype diverged considerably from the two former communes: in Sart, 70% of the land was owned by local peasants (Alter et al. 2004c, p. 205). Combined with strong population growth and the French inheritance laws, ever smaller farms remain after the division of property. In 1846, 54% of the farms were smaller than 3ha (Carmanne 2005, p. 196). On these small farms, farmers usually had 1 or 2 cows and cultivated oats, rye and potatoes (ibid). With parcels too small for subsistence farming, these farmers would often be forced to look for additional income sources. An extract of the coding of the occupations in Sart gives further evidence of this:

"CABARETIER-CULTIVATEUR" = "4"
"CHARON CULTIVATEUR" = "4"
"CULTIV. CABARE. MENUISIER" = "4"
"VOITURIER CULTIVATEUR" = "4"
"CULTIV. CABARE." = "4"

Often, other than in the Familienbuch Euregio data, EAP data on farmers would either contain extra information about an additional occupation or the additional attribute of the farmer being the owner of their piece of land and therefore a full time farmer:

"PROP.,CULT." = "4"
"PROPRIETAIRE CULTIVATEUR" = "4"

Only after 1850 did significant migration lead the remaining farmers to consolidate their farm sizes and values. During this period, increased productivity could be achieved through increasing scale and using fertilisers (Alter et al. 2010, p. 200). In any case, the principal economic activity in Sart throughout the 19th century remained agriculture (Alter et al. 2004c, p. 175), as the occupation data for Sart shows (first mentioned occupation):

Table 25: The Social Strata of Sart in the 19th Century (1810 – 1899)

	Men		**Women**	
		Share of working		**Share of working**
Social Strata	**n**	**population in %**	**n**	**population in %**
Elite	4	0,22	1	0,05
Lower Middle Class	15	0,81	1	0,05
Self-employed, Skilled	78	4,23	17	0,92
Farmers	395	21,44	237	12,85
Low/ Unskilled	234	12,69	382	20,71
N/A	215	11,66	265	14,37
Sum	941	51	903	49
Total Working Population	1844			
Total Working Population in Percent	100			

Source: EAP Sart Data, own calculations

The bulk of Sart's working population lived from agriculture. 34.3% were classified as farmers. Additionally, of the 33.4% lower or unskilled workers, many must have been seeking jobs in agriculture (as day labourer farm hands, for instance), as the industrial centres were some distance away. The remaining population was composed of a very small, almost negligible elite and middle class (together: 1.2%) and a relatively small group of skilled workers.
The data for Sart, mainly derived from censuses, contains a lot more information on occupation, leaving only 26.3 % of the sample without one. Still, considerations made for the other two villages

are employed also here. Day labourers, unskilled workers and some well-off women should be expected in this category.

When comparing the composition of only the classifiable individuals of the three communes in one table, as in Table 26, differences and similarities in ecotypes become more easily visible:

Table 26: The Known Social Strata of Würselen, Meerssen, and Sart, 1810 – 1899

Men						
	Würselen		**Meerssen**		**Sart**	
Social Strata	**n**	**Share of all known men in %**	**n**	**Share of all known men in %**	**n**	**Share of all known men in %**
Elite	32	1,20	48	3,35	4	0,55
Lower Middle Class	133	4,98	92	6,43	15	2,07
Self-employed, Skilled	1452	54,32	389	27,18	78	10,74
Farmers	178	6,66	172	12,02	395	54,41
Low/ Unskilled	878	32,85	730	51,01	234	32,23
Sum	2673	100	1431	100	726	100
Women						
	Würselen		**Meerssen**		**Sart**	
Social Strata	**n**	**Share of all known women in %**	**n**	**Share of all known women in %**	**n**	**Share of all known women in %**
Elite	4	0,80	3	0,44	1	0,16
Lower Middle Class	13	2,61	34	4,99	1	0,16
Self-employed, Skilled	212	42,57	58	8,50	17	2,66
Farmers	7	1,41	14	2,05	237	37,15
Low/ Unskilled	262	52,61	573	84,02	382	59,87
Sum	498	100	682	100	638	100

Source: Familienbuch Euregio, EAP Sart Data, own calculations

Würselen and Meerssen both had more industrialised ecotypes, comprising a high share of skilled and unskilled workers. In both communes, the share of farmers was below 10%. The differences between the two lie in the distribution of wealth: Meerssen had a larger share of rich people (7.6% belonged to the elite and lower middle classes) and many more poor people (67.25%

low/unskilled) than Würselen (4.79% elite and lower middle class; 42,73% low/unskilled). This difference is mainly explained by the fact that there are many more low or unskilled workers in Meerssen. The ecotypes were quite similar, as the share of workers was quite equal: 91.17% for Würselen and 85.36% for Meerssen.

The society of Sart was quite different in structure to Würselen and Meerssen. The upper and the lower middle classes accounted for 1.47% of the population, indicating a general low level of wealth. The greatest difference, as indicated above, can be found in the share of farmers. 64.35% of the occupations assigned fall into this category. Assuming that only some of the large share of low and unskilled workers also worked in agriculture, it becomes clear that more than two thirds of Sart's working population were in agriculture (the real figures likely being higher). The share of skilled workers was thus very low, about 12%, indicating a non-sophisticated economy with little use for a skilled labour force. Additionally, the very low number of lower-middle-class people, who would have been needed mostly for supervision, further supports this finding. It can therefore also be expected that Sart will be different in its migration patterns to the other two communes.

Migration

According to Korres, migration in the Border Triangle falls into three periods, which are comparable to those detailed for industrialisation levels in 4.1: under French occupation, most of the migrants of the Border Triangle left for Holland, with its overseas trade centres. The amount of migration not caused by war would still have been very limited. After the French left, a second phase of migratory movements began during early industrialisation. Its character was marked by intense short-distance migration inside the Border Triangle, mainly without crossing the border, from home-production regions (like the Eiffel region) to the early industrial centres along the Liège-Verviers-Aachen-Stolberg axis. In the third phase (heavy industrialisation), the textile industry was replaced as the leading sector of production by mining. At the same time, the early industrial centres lost their roles for attraction to the rapidly and heavily industrialising centres in the Ruhr region. Border-crossing migration had its peak at this phase (Korres 2002, pp. 10ff).

Würselen indicates some fluctuation in migration patterns during the second phase of Korres' classification. Table 27 shows the population growth of Würselen from 1825-1866 in The Mayor's

Chronicles, including its birth/death balances and migration residualin the respective year of reference.

Table 27: Birth/Death Balances and Migration in Würselen, 1825 – 1866

Year	Population growth	Birth/Death Balance	Migration residual
1825*	120	47	73
1831	111	55	56
1836	153	58	95
1841	76	51	25
1846	-95	62	-157
1850	88	26	62
1856	113	52	61
1861	108	12	96
1866	0	61	-61

*some years are missing, therefore the timescale varies between 4 and 6 years
Source: State archive in Liège, The Mayor's Chronicles, author's own material, own calculations

Except for the years 1846 and 1866, there was both a constant migration influx and a natural population growth. This led to considerable overall population growth, with in-migration mainly (but not exclusively) responsible. While the out-migration of 1846 is explained by the troubles of the hunger years of 1846/47 in the region,[49] 1866 surely correlates with the turmoil of the Fraternal War in Germany. In any case, it becomes clear for the other years that the possibility of working in the mining fields close to Würselen must have attracted migrants. It is especially during the decades of high growth that most migrants are registered – the 1820s, 1830s and 1860s (see Table 9). Due to the limited period of The Mayor's Chronicles, we do not have any further information on the third phase.

For Meerssen, only the third period is available in numbers. Table 28 again shows population growth, birth/death balances and migration residuals for the end of the year of reference.

[49] Though not as striking as in Prussia's eastern provinces, harvests amounts of potatoes for instance declined to 2/3 of a normal harvest in 1846 (Bass 2012, p. 151).

Table 28: Birth/Death Balances and Migration in Meerssen, 1876 – 1901

Year	Population growth	Birth/ Death Balance	Migration Residual
1876*	53	44	9
1881	42	66	-24
1891	75	41	34
1901	164	111	53

*Figures for the end of the year indicated
Source: Oberndorff and Niesten 1994, p. 222, own calculations

In Meerssen, there was constant migratory growth (except for 1881, which remains unexplained). Unlike Würselen, the main share of this growth was achieved through natural growth, leading to slower overall population growth in Meerssen.

Sart, as might be expected, has a completely different migration pattern. Table 29 shows the birth/death balance and the migration balance for the second and the third phases of Korres' migration periods for Sart.

Table 29: Birth/Death Balances and Migration in Sart, 1811 – 1900

	1811 - 1845	1846 – 1872	1873 - 1890	1891 - 1900
Birth/ Death Balance (‰)	8.18	5.57	8.98	6.65
Migration Balance (‰)	-2.75	-11.05	-9.77	-7.64

Source: Neven 2002, p. 43

Of the three communes, Sart is the only one with constant out-migration, first on a level that lowers population growth in the second migration phase (here, 1811 – 1845) and then on a level that actually outpaces natural population growth to a large extent, in the second half of the century. In total, from 1811 – 1900, Sart lost 6,067 people to out-migration and regained 4,390 people through in-migration, a net loss of 1,677 people (Neven 2002, p. 41), with most leaving Sart from 1846 onwards.

According to Alter et. al., as a result of this, the great economic hardship in Sart during the first half of the 19th century was established by proto-industrialisation, with the remaining agriculture declining in the second half. As a result of slowly growing output, out-migration and some

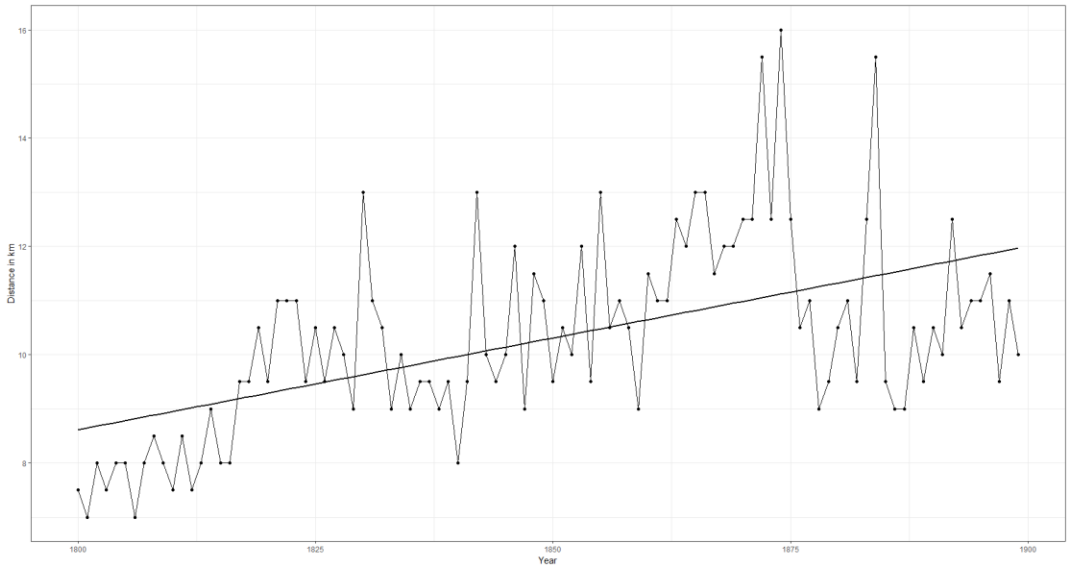
migrants likely sending money back to the members of their families left in Sart, mortality went down (Alter et al. 2004c, p. 192).

The view of Sart as a rather unattractive place for migrants is further supported by the archive work revealing that the number of foreigners in the commune of Sart grew from 0 in 1839 to 1 in 1844 and 2 in 1845 (State archive in Liège, unassigned, author's own material). The one foreigner in 1844 was a Prussian gardener, aged 26. The second foreigner came in 1845, who was also Prussian but whose sex and age were not recorded - this could be the gardener's wife, who may have followed him to Sart. In any case, with only 2 foreigners in a population of about 2,400 (less than 1%), the notion of Sart as a rather isolated place is further confirmed.

Further deconstructed, out-migration as a demographic reaction to economic pressure is itself strongly related to variables such as property and family organisation and ties: according to Oris, Alter, Servais, in comparison to land holding farmers, other societal groups have a greater risk of migration (Oris et al. 2014, pp. 278f, 284f). We can directly infer a stress-attenuating function to migration for the lower strata of society (day labourers, textile workers) here. Additionally, the hypothesis of stronger family ties being a better supporter for an individual detailed in 2.2. is further supported by the findings of the EAP researchers: the absence of both parents more than doubles the likelihood of an individual migrating, whereas the presence of siblings lowers it (ibid.). These scholars only find the effects of changing rye prices on migration patterns for women (Oris et al. 2014, pp. 279). However, the period with the general highest migratory movement is 1875-1890, when American grain flooded the European markets and greatly worsened the economic situation in Sart (Oris et al. 2014, pp. 281f).

An analysis of the distance of birthplaces from one generation to another shows migration patterns for the entire region: 160,626 individuals born within the Border Triangle could be linked to both of their parents, who were also born within the region. Figure 16 describes the overall pattern for the 19th century.

Figure 16: Average Migration Distance in the Border Triangle (Belgium, The Netherlands, and Germany) from one Generation to the Next in the 19th Century



Trend: linear trend. Source: Familienbuch Euregio, own illustration

This figure clearly shows a rising mobility trend. As described by Korres, migration increased in the region throughout the century, and migration distances became greater from one generation to the next. The falling rates towards the last quarter of the century can only be explained by people migrating even further, to destinations outside the Border Triangle. As these individuals are lost in these statistics, this explanation is convincing.

After the identification of the most formal institutions, the final part of this chapter will reconstruct the 'super' informal institution of the prevailing family organisation and family ties in the region.

4.2.5 Savings, Borrowing, Poor Relief, Household Labour Supply and the Family Organisation

Figure 17 is a zoom in into the demographic responses influencing institutions from Figure 6. It will once more remind us of an aspect that has been elaborated upon in the theoretical framework section.

Figure 17: Demographic Responses Influencing Institutions - Zoomed In

Source: own illustration

As indicated above, the culturally-shaped, informal institutions of family organisation and family ties affect almost all reactions to short-term economic stress. Long before formal public institutions came about, the family served as crises attenuator for its members. Following Todd's classification of traditional family structures in Europe (Todd 1996[1990], p. 74), rural families in the Border Triangle were stem family systems in Limburg and the district of Aachen, and a mostly incomplete stem family system in eastern Belgium. From these different family norms emerge differences in the strength of family ties, patriarchy levels, family size, and levels of sibling support.

With its rural character, underdeveloped land market and incomplete stem families that tended more towards an equal division of property, we can expect stronger family ties in Sart than the other two villages. The ties between parents and children could be expected to be strong, at least until the bulk of the inheritance is divided after the death of the parents (Todd 1996[1990], pp. 64-67). Parental decision-making affects marriage chances more in patriarchal societies. The inheritance mass might be set free after the death of the head of the family, typically the father, and with it the possibility of marrying. If redistributed earlier on, however, the father would obviously have had a strong vote in the suitability of a marriage partner. The complete stem families of Würselen and Meerssen, with impartible inheritance and only one male heir, would also point to a lower level of patriarchy when compared to Sart on the whole. Partible inheritance, especially for undeveloped land markets and limited resources, is associated with low fertility, e.g. through older marriage ages and life-time celibacy (and therefore smaller families). Family size has a clear relation to resource dilution. The larger the family, the more the resources have to be divided among members of the family, potentially leading to less likelihood of marrying for the individual. A possible exception is the first-born son in stem family areas with primogeniture. We

would thus expect positive effects from being a first-born son in Würselen and Meerssen in terms of the likelihood of marriage in comparison to Sart. For sibling support, we should expect the highest levels of support to be found in families with the strongest ties. Older children could work, e.g. in the mines or factories, and help with setting up a marriage fund for their younger siblings through shares of their income. The features of certain family systems as specified by Todd, however, essentially pertain to landholding families, which are of a greater importance in Sart (as seen above). Sart must therefore be expected to follow them.

For informal savings in general, according to Bracht, it is very difficult to say anything about the actual practices, as this topic has remained rather largely under-researched. Despite this, and despite the benefits of saving within the family, according to Bracht's review on the hoarding of money in Germany and Sweden, it is likely that savings banks were used by those who could (and where surpluses allowed) right from the start (Bracht 2013, p. 214). As seen above, at the beginning and most probably until the last third of the century of the period studied, formal savings and borrowing possibilities were insufficient to completely buffer short term economic stress for the lower strata of society. Additionally,

> "[s]aving and borrowing outside the [family] network brings a social cost, most importantly the erosion of the reciprocity on which network members depend (Lis and Soly, 1993, 2009; Van Leeuwen, 1994). This cost is reflected in a peculiar but entirely rational inversion of the economics of outside saving. When households exceptionally deposit money with a cash keeper, they do not earn interest, but pay a fee for that service because it safeguards temporary surpluses from network claims (Collins et al., 2009, p. 21-22). Consequently households start saving outside their network only if their income generates a sufficient surplus to end the cash flow juggling" (Deneweth et al. 2014, pp. 89f).

According to Deneweth et al., for the Netherlands, before the spread of Dutch savings banks, poor families would rely on 'cash flow juggling', meaning they would use inner (familial) financial 'services' (Deneweth et al. 2014, p. 89) to attenuate short-term economic stress. The financial portfolios show a continuous switching in and out of saving, in various forms and mostly within a network (ibid.).

While strong family ties might help in accumulating savings, they are even more useful when it comes to providing help when saving was not possible in advance. Informal, non-bureaucratic (and therefore quicker) lending agreements would allow for easier cash flow–smoothing in times of pressure. Wehber states, despite the emerging credit institutions described above, that the first option a credit-seeking individual would look for in the 19th century was indeed the family

(Wehber 2013a, p. 92). However, though some information on widespread informal lending is found in the local literature (Wehber 2013a; Neven 2002; Rutten 1995; Bracht 2013; Cornips 1953), its exact spread remains immeasurable and therefore mostly invisible to the historian. The two options the historian has for reconstructing this institution and its effects on attenuating economic stress are to review the ‘opposite' possibilities (formal lending) and derive the probability of them being used (see above), and to include proxies in the statistical models. According to the theory, we would expect the closest member of kin to help first: when following Bracht, the closer the contracting parties, the lower the rates of credit and the less the security has to be provided by the debtor, either because of altruistic motives inside the family circle or because of the difficulties one might face when asking for interest (Bracht 2013, p. 153). If, for instance, a couple’s mothers are alive, does the couple cope better with economic stress than a couple who have already lost these close relatives? This question will be answered in Chapter V.

'Private poor relief' follows the very same logic as informal borrowing. The only difference is that the money is not supposed to be paid back, and the food is not expected to be given back by the individual or couple. As shown in many studies, 'private poor relief' is a central feature in families (Wall 1998, p. 45; Reher 1998; Alesina and Giuliano 2007), and family organisations and ties play a crucial role here (Wall 1998, p. 64; ibid). As mentioned in the theoretical part, family characteristics and the strength of their ties should also be expected to correlate with the amount of help given to needy family members. However, as shown by Mandemakers and Kok, a more nuclear family organisation is not necessarily weak in terms of the commitment of family members to one another. Sometimes these families offered even more 'private poor relief' than stem families (Kok and Mandemakers 2012, pp. 20f).

In any case, despite its activities and inventiveness, borrowing, lending, or ‘private poor relief’ from the family, a family’s help very did not suffice to smooth economic stress enough to make those affected resilient to it. If the shocks were too strong, too numerous or if the family’s overall resources were just not enough to help out, shock absorption was seldom possible (cf. Deneweth et al. 2014, p. 90, drawing on Collins 2009, pp. 52, 65-94). Alternatively, migration took place. The problem with migration is that it often results in a weakening of already weak family ties for those who migrate, resulting in a loop of less informal support and more formal economic stress attenuating institutions needed in general.

Before moving on to the results and discussion in Chapter V, it will be useful to give a systematic overview of what has been detailed here for potential stress-attenuating institutions. It becomes clear here which institutions remained possible drivers for differentiation in demographic behaviour under economic stress, and which did not.

4.2.6 Reconstructed Institutions – A Summary

The goal of this sub-chapter was to describe the institutions that combined two characteristics: a potential short-term economic stress-attenuating function, and observable differences in either their time of appearance or their short-term economic stress-attenuating function. While the former has been described above, the latter can be summarised in the following table:

Table 30: Summary of Contextually-Studied Institutions and Practices

	Field Sites			
Institution/ practice	**Würselen**	**Meerssen**	**Sart**	**Differences**
Property Rights	strong property rights granted	strong property rights granted	strong property rights granted	no
Inheritance Laws	equal division of property	equal division of property	equal division of property	no
Savings Banks	in use from 1829/1834	in use from 1853/1854	in use from 1865/1880s	yes
Bank Borrowings/ Bank Mortgages	in use since the mid century/ mid century	in use since 1874 or later/ from 1874	last quarter of century/ last quarter of century	yes
Pawn Shops and similar	widely used before savings banks	widely used before savings banks	widely used before savings banks	no
Poor relief	basic, growth last third of century	relevant, growth last third of century	basic, growth last third of century	yes, small
Social Laws	modern Social Security 1870s	constant revisions, full modern social security 1900s/1910	modern Social Security 1890s	yes
Labour Market	liberal since French Period	liberal since French Period	liberal since French Period	no
Female Labour/ Ecotypes	common/ mainly workers	common/ mainly workers	common but less life-cycle servants/ mainly peasants	yes
Migration	in-migration	in-migration	out-migration	yes
Family Organisation & Ties: inheritance practices, informal saving & borrowing (poor relief)	stem family	stem family	incomplete stem family	yes
Marriage	*this study*	*this study*	*this study*	*to be determined*

Source: own illustration

This reveals institutional similarities and differences among the three communes. Clearly, with no differences in granted property rights, they will have no importance in explaining heterogeneity in the demographic decision making of individuals and couples. This statement is also true for

inheritance laws. The first formal institution that actually had the potential to make a difference in demographic decision-making was the savings bank. Banks that allow for small savings and credit were different in terms of the time of their appearance and their benevolent character. Pawn shops and similar small money trading played a considerable role, at least until the advent of formal savings possibilities. A real difference in magnitude of their use, however, is hardly possible to define. Basic poor relief was quite similar in all three communes, though with the most favourable conditions for Meerssen. However, its general rudimentary character suggests that only through growth during the last third of the century, in combination with the introduction of large-scale, nationwide social laws, economic stress can really be attenuated successfully for each strata. Since the invention of these laws, which were step-wise and came at different times, differences in the impact on demographic behaviour under economic stress should be observable. The labour market was also quite similar since the French period. Its liberal character, women's participation in the labour market and the overall terrible working conditions (especially in the first half of the century) are rather comparable for the three communes. Holding ecotypes constant is somewhat hindered between Sart on the one hand and Würselen and Meersen on the other hand. This is because Sart accounts for many more peasants in relation to its population than the other two. Additionally, these peasants were poorer than their counterparts in Würselen and Meerssen because of their smaller estates. Differences are also found in family organisation: the complete stem families of Würselen and Meerssen point to a somewhat lower level of patriarchy and somewhat looser family ties when compared to the incomplete stem families in Sart, as property division affects all the children in the latter commune, tying them strongly to their parents. The institutional differences for Würselen and Meerssen are the formal institutions of savings and credit banks, poor relief and social laws. The remainder of the disparities in individual and couple demographic behaviour has to be explained through family organisations and ties.

V The Preventive Check of Marriage: Results and Discussion

This chapter will analyse the preventive demographic behaviour of individuals and couples, particularly focusing on preventive family planning measures (preventive check) through delaying marriage. The most relevant descriptive statistics are used as a starting point, followed by statistical modelling as introduced under 3.5. Concluding the chapter will be a discussion of the obtained results. This will be achieved through the integration of the institutions marked as "Yes" under the "Differences" column in Table 30 into the statistical models as much as possible. The main task of this chapter is therefore to identify differences in preventive demographic decision-making and to explain these with and through the historical context and the reconstructed institutions elaborated above. The procedure will be the same for all three communes: first, a full model that encompasses the period of 1810 – 1899 and all variables will be shown. Second, this full model will be extended by the interaction effects of these variables with economic stress. The third step will involve splitting these full models with interactions into three separate models for each of commune where possible. Where this is due to the number of events not possible, two periods may be summarised as one. This method facilitates an analysis of the general effects of the variables used, the influence of the interaction effects on the model(s), as well as of the change throughout the 19th century.

The calculations will be carried out with the same diligence used for the reconstruction of the historical background and the institutions relevant for economic stress. However, due to the nature of the historical sources and the resulting "social facts", any attempt to put a real-life historical world into statistical models must not be treated as `absolute´ findings. Instead, the following presentation and interpretations reveal only 'possible' results: the "stylised facts" offer an original 'interpretation,' 'reading,' or 'way of making sense' of a certain slice of the empirical world. They may shed new light on an empirical problem, help one understand some social process, or reveal what 'really' went on in a certain conjuncture" (Abend 2008, p. 178). The "stylised facts" that will be elaborated in this chapter "are not full-blown explanations or theories, nor are they simple reports of a set of specific facts. Rather, they are lightly theorized descriptions – theories of what

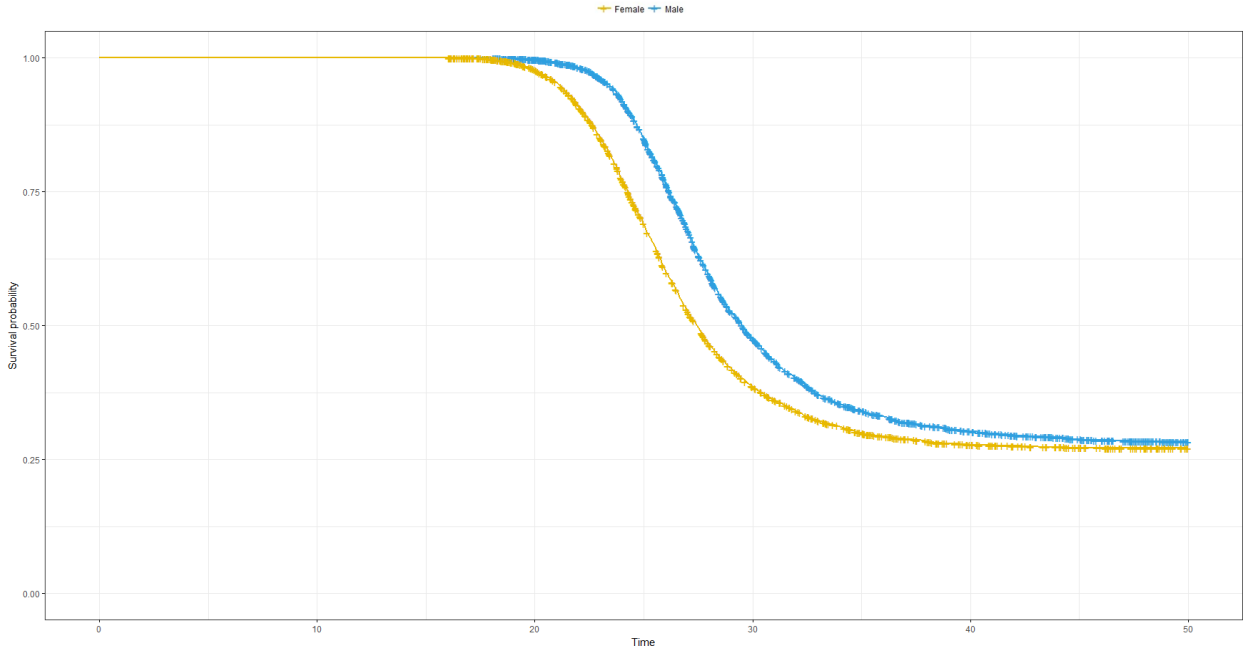
is and what is worth noticing" (Hirschman 2016, p. 608). All in all, they help us to create a likely picture of the 19th century in the Border Triangle, as well as to approach its historical reality.

5.1 Würselen

5.1.1 Descriptive Statistics Würselen

The following graph provides a brief overview of the marriage behaviour in Würselen by depicting the overall risk of not marrying for the selected population during the 19th century.

Figure 18: Probabilities of Not Marrying in Würselen 1810 – 1899



Source: Familienbuch Euregio, own calculations and illustration

Figure 18[50] shows the chances of "failing" to not marry (see chapter 3.3 for in depth technical explanations). The construction of this figure will be identical for all three communes. Any potential flaws and distortions will be addressed through an interpretation of the figure for Würselen, which due to the similar data for Meerssen and Würselen will also be applicable for

[50] See also figures 24 and 25 in the appendix for further insights of descriptive marriage behaviour with slightly changing parameters.

Meerssen too. The first limitation appear at the survival time of 16 years for women and 18 years for men. As described above, the first observations are accepted at these ages, the last observations at age 49.999 for an individual. The graph clearly shows a distribution commonly found in analyses of marriages in historical Western European societies: the risk of not marrying decreases cumulatively over time, especially between the early 20s and the late 20s for women and the mid 20s and early 30s for men (Collenteur and Paping 2004; Dribe and Lundh 2014; Derosas et al. 2014).

Moreover, it seems there is a rather large share of people that never experience the event of marriage. However, it is important here to notice that the survival models take only the events into account that have an assigned date. The share of about 27% of people that never experienced an event in the above figure thus does not wholly reflect the amount who never married in Würselen. As a reminder, Hajnal calculated figures of somewhat between 10-20% (see again chapter 2.1) of life-time celibacy for an ideal EMP. Figures found by Knodel and Maynes (Knodel and Maynes 1974, pp. 131, 139) for the district of Aachen in 1880 also indicate much lower figures with about 12% of people who never married. This chapter adopts the same methodology for the same year of 1880 as applied by Knodel and Maynes,[51] applied not to the census data but the Euregio Familienbuch sample.

Table 31: Deceased and Never Married in Würselen 1800–1899

	1800 - 1899					
	M	Share	F	Share	Total	Share
Deceased	6964		6533		13497	
Deceased 45 - 49 years	214	100.0%	141	100.0%	355	100.0%
Deceased 45 - 49 years not married	27	12.6%	15	10.6%	42	11.8%

Source: Familienbuch Euregio

This table shows the number of deceased individuals in Würselen from 1800-1899 divided into males (M) and females (F). The ratio of the deceased between 45 – 49 years and the singles among them is 11.8%. The figures of 11.8% obtained for permanent celibacy/ for those who never married

[51] "The percent single among persons aged 45-49 is used" (Knodel and Maynes 1974, p. 133) for approximating the percentage of those who never married in a village where they have also died.

in Würselen (Familienbuch Euregio) represent a much more plausible picture. These figures clearly point to an European marriage pattern in Hajnal´s sense.

According to Hajnal, another indicator for the Western European marriage pattern is a rather high mean age for marriage (about 24 years for women, 26 for men, see again chapter 2.1). The following table, which tests these figures for Würselen, shows the mean age of men and women when they first married in the 19th century. These are divided into 10-year periods and include age differences. Again, according to Hajnal, it should circle around 2 years in EMP areas with rather low patriarchy levels, at least when compared to most other parts of the world.

Table 32: Mean Age of First Marriage and Age Differences of Partners in Würselen 1810 – 1899

	Mean Age of first Marriage			
Period	**Total**	**Men**	**Women**	**Age Difference**
1810	26.5	27.3	25.8	1.5
1820	27.2	27.9	26.5	1.4
1830	26.9	27.4	26.3	1.0
1840	27.5	28.6	26.3	2.4
1850	27.8	28.7	26.8	1.9
1860	27.1	28.3	25.9	2.4
1870	27.1	28.3	25.9	2.4
1880	27.2	28.1	26.3	1.8
1890	26.6	27.7	25.6	2.1
Mean	27.1	28.0	26.1	1.9

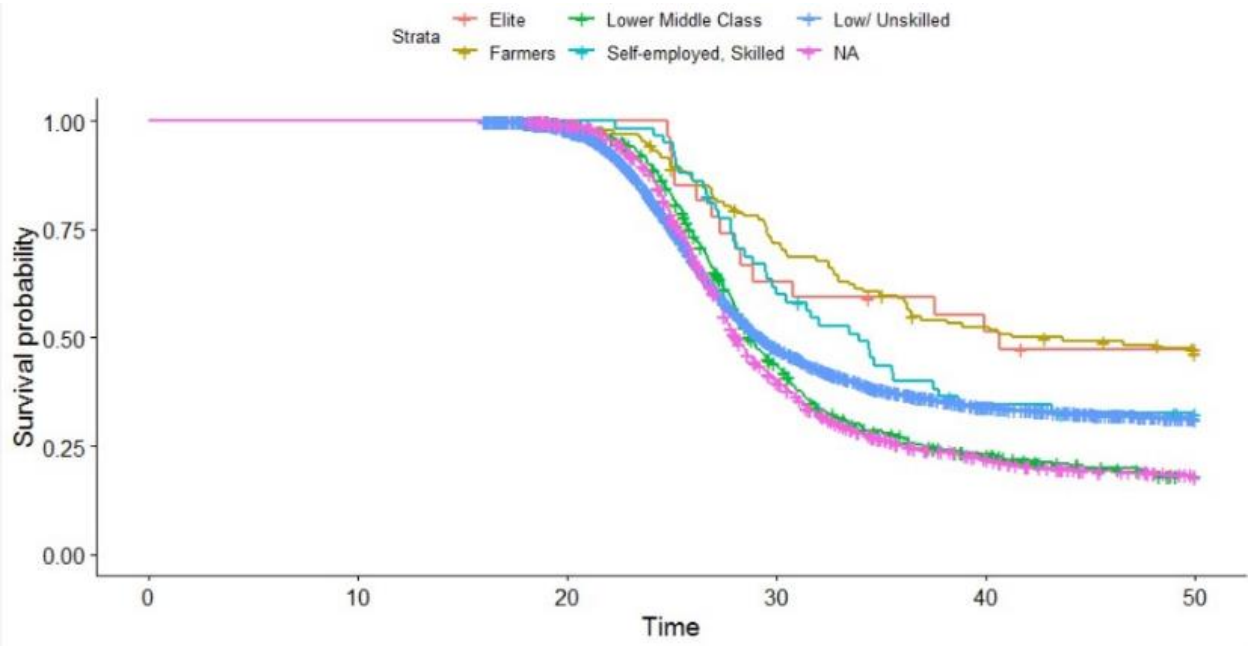
Source: Familienbuch Euregio, own calculations

The mean age of marriage remains rather stable throughout the century with a maximum of 1.3 years of deviation between the highest (27.8) and the lowest (26.5) mean age of marriage. The highest age of marriage for both men and women are found during the 1850s, the lowest at the beginning and end of the century. For men, the mean age at first marriage never reaches above 29.0 years, for women never that of 27.0 years. Still, the figures are considerably higher (about two years for both sexes) than those calculated by Hajnal, indicating a difficult environment to build a marriage fund. External circumstances present a challenge to all young couples. Age

difference between the partners in the first third of the century is rather low instead, namely 1.2 years. Throughout the remaining decades, this then increases to roughly 2 years as predicted by Hajnal, with the figure only slightly surpassed in the middle of the century. This increase mainly results from a rising age of marriage for men, beginning exactly when industrialisation really gains pace and pauperism approaches its peak. In general, such rather small age differences between the partners point to low levels of patriarchy (Gruber and Szoltysek 2012, p. 18). Two additional components of the "Patriarchy Index" for "Male Domination" as developed by Szoltysek et al.´s (Szołtysek et al. 2017, pp. 236ff) support this view.[52] The "Proportion of Young Brides", 0.03, and the "Proportion of Older Wives", 0.31, the former being relatively low, the latter being relatively high when compared to the means of 0.06 and 0.22 respectively for Europe found by Szoltysek et al. (Szołtysek et al. 2017, pp. 238.) When now showing the relative risk of not marrying for the different social classes, the following insights can be obtained.

[52] In their Patriarchy Index Szoltysek et al. patriarchy into four "domains": "the domination of men over women, the domination of the older generation over the younger generation, the extent of patrilocality, and the preference for sons". Out of these four, the narrower concept of "Male domination" of the "domination of men over women" is directly related to marriage and therefore of most interest for this study. With the data available for the present study, the two indicators the "proportion of ever-married women in the age group 15-19 years" ("Proportion of young brides") and the "proportion of all wives who are older than their husbands among all couples for whom the ages of both spouses are known" (Proportion of older wives") are able to be reconstructed. The first indicator is associated with the positive effects of patriarchy, the second indicator with its negative ones (Szołtysek et al. 2017, pp. 235f.).

Figure 19: Probabilities of Not Marrying in Würselen 1810 – 1899 by Social Classes



Source: Familienbuch Euregio, own calculations and illustration

Particularly striking are the high ratios of late marriages for both the elite and the farmer´s class. With a rather similar marriage pattern, it is possible that marriage behaviours in both classes lean towards a niche principle: namely that the successors from both classes would have to wait for a niche to become free in order to receive an inheritance and marry. This remains difficult to prove for the elite due to the limited amount of cases. The other classes lie more on the overall average distribution with the two lowest classes marrying close to the averages shown in Figure 19. The lower middle class as well as the NA cases have the highest chances in marrying. For the former, apparently, enough capital means freely allow to choose marriage, whereas the many women in the latter possibly tilt the curve to lower the age of marriage when compared to the other curves.

The following will now further analyse the institutions that might attenuate this situation of constraints. The statistical description of the means and frequencies of the independent variables used in the models for Würselen is provided in Table 33:

Table 33: Means and Frequencies of the Variables Used in the Modelling of First Marriages in Würselen 1810 – 1899

Price_Cycle_Wheat (t-1)	Mean	Standard Deviation					
	0	0.14					
First_Born_Male	No	Yes					Sum
Number	6500	875					7345
%	88.1	11.9					100
Gen	Male	Female					Sum
Number	3647	3698					7345
%	49.7	50.3					100
Fath_Dead	No	Yes	NA				Sum*
Number	3778	2771	2132				8681
%	43.5	31.9	24.6				100
Moth_Dead	No	Yes	NA				Sum*
Number	4207	1998	2307				8512
%	49.4	23.5	27.1				100
n_Older_Siblings	0	1	2	3+	NA		Sum*
Number	3851	1371	656	414	1570		7862
%	49.0	17.4	8.3	5.3	20		100
Hisclass_5	Elite	Lower Middle Class	Self-employed, Skilled	Farmers	Low/ Unskilled	NA	Sum
Number	36	146	1664	185	1140	4174	7345
%	0.5	2	22.7	2.5	15.5	56.8	100

*Double-counting from time-variation resulting in changing spells. Changing spells added to n=7345
Source: https://histat.gesis.org, Familienbuch Euregio, own calculations

When beginning with simulating economic stress, it is important to note that the price-time series for Cologne and resulting variables of Price_Cycle_Rye and Price_Cycle_Wheat (see again 3.2) hardly reveal any statistically significant results for t0 nor for t-1 prices. Thus, despite its 70km

distance from Würselen, the Cologne market is located too far away to have a strong direct impact on the demographic behaviour of the Würseleners. This is further supported by the remarkably low intercity price correlation between Maastricht and Cologne, as shown in chapter 4.1. After several trials using alternative methods to simulate economic stress, such as applying other price available indicators from the region as described under 3.4 as well as shifted time lags from 0-2 years in steps of four months for each trial, the models revealed that the yearly t-1 wheat prices of Maastricht(!) offered the most stable and statistically significant results for Würselen. Thus, the rather high price fluctuations for wheat found throughout the entire century had a profound influence on the people. The prices of the market of Maastricht are therefore taken as the proxy for economic stress here.

First-born males constitute 11.9% of the sample. However, 4.4% of the 88.1% of summarised not first-born males are without indications on birth order and are therefore not determinable. As only a fraction of these 4.4% are possibly first-born males, this small amount of NA cases was thus not convincing enough to justify an additional NA variable. The additional separation between genders for this variable appeared to not be advisable when adhering to the philosophy of the most parsimonious model. Such a separation would have created 8 additional variables in models with interaction effects, producing models too large for stable results. As a result, the decision was made to remain with a simpler variation comparing the effects on marriage depending on whether one is a first-born male. As the calculation's results will illustrate, significant results could be obtained through this method.

Also noteworthy to mention is the rather equal distribution of men and women at risk; a distribution that should not favour the chances of marrying for any of the two groups.

The death of the parents is known in 75.4% of the cases for fathers and in 72.9% for mothers. As could be expected, fathers die earlier than mothers and more often die before the marriage of their children than mothers. Hence, it could be expected that in most of the NA cases, neither the father nor the mother has not died yet. This assumption is often made in research on infant or child mortality (see e.g., van Dijk and Mandemakers 2018), where it is indeed very likely to be true. However, making this assumption for marriages, where many individuals marry in their mid 20s or later is not advisable. Due to the higher age of the parents, they are more likely to have passed away at the time of their child's marriage compared to their child's birth. What is actually indicated by the data itself is that most NA cases are from individuals who are not born in Würselen – in

other words, individuals who migrated at some point in time in their life to Würselen. These are a little more than 50% of the NA cases.

About 24% of the individuals of the sample are first-borns (including both males and females). The unusually high share of 49.0% of individuals with no older siblings for 19th century Würselen (the about 24% of the first-borns would be expected) is explained by the fact that the birth order figures are taken directly from the original database whereas the n_Older_Siblings variables is constructed with the already-sampled data. This variable counts actual living siblings only and some older siblings would have died before 1810. Thus, they would not appear in the sample as *living* older siblings, reducing the share of actual older siblings that were matched. Additionally, the censoring of the periods is necessarily cutting off earlier and especially later years of living siblings. The NA cases again point to a considerable share of immigrants who could not be matched with other relatives (as was the case with parents) in the original database of the Familienbuch Euregio. 87.2% of these immigrants have no older siblings or an NA case. The largest group of NA values are found in the Hisclass_5 variable. As explained above (see again chapter 3.5), taking these out of the sample would be detrimental in the sense that all these cases and their events would be lost for the analysis, resulting in models of significantly lower stability. The sheer size of this and the other NA groups instead guarantees statistically significant results for these groups. This NA cases group poses further difficulty interpreting it as it is mainly comprised of women of probably better status and some men of lower status. The true danger with interpreting this Hisclass_5 group, however, rather lies with the elite group due to the low number of cases, further reduced by the division of the century into three periods. Consequently, the results obtained with this variable should be interpreted very carefully.

The following section will examine the calculation results with more clarity on the models and their respective variables achieved through the above description.

5.1.2 Results Würselen

In this subchapter the calculation results for Würselen will be shown and interpreted. Each of the following result tables present the number of individuals analysed, the number of events that occurred, the calculation results for all variables, and the goodness of fit values for the models as a whole.

As already mentioned above, for clarity the full model will be presented at first without interaction effects in order to show the main effects of the relevant variables for the entire 19th century. This will then be followed with how the later-added interaction effects influence the extended model. A deeper analysis is facilitated when the full model is divided into separate models, one for each of the three periods established under 4.1 respectively.

Results Table 2: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (f) to 50 Years, Full Model without Interactions, Würselen 1810 – 1899

Individuals 7345, number of events = 4790

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		-0.214	0.807	0.109	3.840	0.050	**.**
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.197	1.218	0.042	22.250	0.000	*******
Gen							
	MALE		1 (ref)				
	FEMALE	0.330	1.391	0.039	70.830	0.000	*******
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.131	1.140	0.034	14.520	0.000	*******
	NA	-0.024	0.977	0.044	0.300	0.590	
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.209	1.232	0.038	30.390	0.000	*******
	NA	-0.007	0.993	0.040	0.030	0.860	
Savings_Bank_in_Use							
	FALSE		1 (ref)				
	TRUE	0.192	1.212	0.050	14.480	0.000	*******
Small_Credits_avail							
	FALSE		1 (ref)				
	TRUE	0.238	1.269	0.038	38.540	0.000	*******
Older_Siblings							

n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		0.087	1.090	0.048	3.190	0.074	.
n_Older_Siblings[2]		-0.048	0.953	0.066	0.540	0.460	
n_Older_Siblings[3+]		0.034	1.035	0.075	0.210	0.650	
n_Older_SiblingsNA		0.327	1.386	0.044	56.230	0.000	***
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-0.492	0.612	0.269	3.350	0.067	.
Hisclass_5Lower Middle Class		0.258	1.294	0.140	3.400	0.065	.
Hisclass_5Self-employed, Skilled		0.536	1.709	0.102	27.520	0.000	***
Hisclass_5Low/ Unskilled		0.321	1.378	0.105	9.280	0.002	***
Hisclass_5NA		0.003	1.003	0.104	0.000	0.980	
frailty(id)					0.240	0.370	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 28 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -38824.9
Degrees of freedom for terms= 1.0 1.0 1.0 2.0 2.0 1.0 1.0 4.0 5.0 0.2
Concordance= 0.589 (se = 0.004)
Likelihood ratio test= 520 on 18.24 df, p=<2e-16

The full model for Würselen 1810-1899 without interaction effects operates with wheat prices that lag by one year to depict economic stress for the sample population. As with most of the studies in the existing literature (EAP, Fertig and Fertig 2017; Bengtsson and Dribe 2006), for Würselen it is also these t-1 lagged prices that indicate a negative and statistically significant effect of rising wheat prices on marriages. Throughout the 19th century, couples in Würselen react to worsening economic conditions by delaying marriage.

First-born males have a clear advantage when marrying when compared to males who aren't first born, supporting the results of Dillon (Dillon 2010, p. 172). Possible critiques concerning a (genealogical) data-related bias towards a generally *earlier* marriage for first-borns can be rejected here: "[t]he most important conclusion", of the findings by Susanet and Bras in their study on

celibacy and marriage based on Dutch genealogical data,[53] "is that the positive effect of a low birth order on the age of first marriage decreased over the period between 1840 and 1922" (Suanet and Bras 2014, p. 136). This indicates that first-born males would not necessarily marry earlier than their siblings. In Würselen, thus, the positive effects of being a first-born male on marriage can be seen through families favouring their first-born sons, who are more likely to obtain the full or at least the largest share of the parents´ property. This ultimately allows them to marry more frequently than their later-born siblings, thus increasing their overall likelihood of marriage. However, again taking into account Fertig and Fertig´s critiques (Fertig 2003a, pp. 80f; Fertig 2003b, p. 110), chapter 4.2.4 as well as the descriptive statistics in Table 33 demonstrate that the share of farmers in the population is too small to explain these findings with only reference to farmers. Rather, this effect, in combination with the large share of skilled workers, suggests that first-born sons are more likely to take over the non-farming-related businesses of their fathers, hence forcing the later-born siblings to marry elsewhere.

Women, as could be expected, generally marry earlier than men during normal harvest years. The rather equal distribution of men and women within the research leaves little room for the alternative explanations described by Dribe and Lundh (Dribe and Lundh 2014, p. 240), namely that women marry early due to their favourable position on the marriage market.

The death of parents strongly affects the marriage behaviour in Würselen. The death of either parent leads to individuals marrying earlier throughout the century, confirming the findings of Bras and Kok, as well as Voland and Willführ (Bras and Kok 2016, p. 199; Voland and Willführ 2017, pp. 128, 133f). A more thorough interpretation of the results is necessary to find clear evidence supporting either Bras and Kok´s explanation (that relates to the niche principle which sees the child's inheritance of the farm or business as crucial in increasing marriage chances) or Voland and Willführ´s interpretation (that relates to the generational transfer, which serves as a compensation for the loss of the largest income provider) (Voland and Willführ 2017, p. 134). Moreover, one should take into account an explanation that considers the (perceived) obligation of children to take care of their parents during old age, often resulting in individual caretaking arrangements driven by altruism and moral obligation (Bouman et al. 2012, pp. 21f), which then

[53] That is the WieWasWie data that also constitutes a large share of the data of the Familienbuch Euregio for Würselen.

hinders marriage chances. As illustrated in chapter 4.2, inheritance practices were often characterised by passing on property from still-living parents to their children through contracts that included forms of caretaking, mostly financially but also sometimes physically (see for instance Brettell 1991, p. 488). On the one hand, these caretaking contracts provided people with enough possibilities for agency to cope with hard times (Bouman et al. 2012, pp. 21f, 29). On the other hand, they also resulted in constraints for as long as the parents were alive. These constraints could be a major driver for delaying marriage. Thus, one could potentially observe a correlation between individuals marrying in higher age groups and individuals with a higher risk of having deceased parents. However, as life expectancy rises significantly during the course of the century, and particularly during the last quarter of the century (Marschalck 1984, pp. 167ff; Ehmer 2013, pp. 37), proof of such a bias would only be found if the above-calculated effects were constantly decreasing over time. This will be tested when the models are split into the respective periods.

The effects of having older siblings are only statistically significant for those with one older sibling and for the NA group. It appears that having one older sibling results in a certain advantage for marrying. However, the effect is very small and should therefore not be overinterpreted here. For the NA group, it is very likely that individuals had older siblings who could not be matched. This is because the main share of this group are migrants, whose siblings were not included in the data. It is therefore reasonable to assume siblings for this group too, with a similar distribution as observed with the known cases. Some NA cases might just have no data on e.g., birth location or siblings, and yet still be from the respective town, which explains a considerable share of the remainder of the NA cases. Others might have sibling that are missing from the records either due to migration or missing data. The data structure itself also reveals missing values here. Given that it is impossible to estimate both the number with siblings and then the number with older siblings at a certain point in time, it is better to discuss the NA cases with care only.

However, acknowledging that there are no signs of the negative impacts resulting from having older siblings, resource dilution (Bras et al. 2010; Kok et al. 2011; Öberg 2017) concerning marriage with respect to older siblings so far cannot be proven. Effects of cultural norms in the sense of disadvantages for the youngest siblings cannot be detected either. If anything, the small positive effect of having an older sibling implies some advantage for this group.

The Hisclass_5 variables refer to the farmers. Compared to this class, all strata clearly marry earlier, except the elite. These findings support one strand of existing literature that confirms both

that the better-off, here the elite, as well as the farmers display a lower risk of marriage than the lower strata (Derosas et al. 2014, p. 331; Bras and Kok 2016, p. 199). They do however contradict the findings of Dribe and Lundh as well as Oris et al. who find the self-employed/ skilled workers and the low/ unskilled workers to be constrained and forced to marry later than farmers (Dribe and Lundh 2014, p. 240, Table 7.7; Oris et al. 2014, p. 278). These results point to differences in ecotype structures: as the reconstruction of the historical context has shown, being a farmer in Sart means something very different than being a farmer in Würselen – naturally with implications on marriage behaviour. There are some indications for the niche principle in these results for Würselen, particularly for the farmers. Namely, while farmers in Würselen would have to wait for an inheritance, an interpretation supported by first-borns advantages to marry, farmers in Sart are on the contrary able to set up a marriage fund and thus marriage earlier as they obtain equal shares of property (ibid.). Often this can be attributed to the fact that every additional piece of land brings more prosperity to the owner compared to the landless (Dipper 1986, p. 249; Medick 1997, p. 148) and to having a second occupation next to farming. Those who are most likely to marry in Würselen are found in the self-employed/ skilled group. It might be that specialised businesses were handed over to the next generation earlier than in farming as the industrial environment calls for new impetus and change more frequently.

The positive effects of two more context variables, the Savings_Banks_in_Use variable and the Small_credits_avail variable, clearly show a rising likelihood of marrying earlier the longer the century lasts. These variables, however, must be interpreted with the greatest care as they are contextual variables, namely they technically `only´ add an additional period to the model. These variables, thus, may slightly support the idea of savings and small credit banks easing out constraints but are best analysed contextually.

The following model will be similar to the one above. The only difference is that the above-tested variables will additionally interact with the above-applied t-1 wheat prices in order to demonstrate demographic behaviour under economic stress.

Results Table 3: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Full Model with Interactions, Würselen 1810 – 1899

Individuals 7345, number of events = 4790

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		0.237	1.268	0.753	0.100	0.750	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.199	1.221	0.042	22.650	0.000	***
Gen							
	MALE		1 (ref)				
	FEMALE	0.328	1.388	0.039	69.840	0.000	***
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.134	1.144	0.035	15.120	0.000	***
	NA	-0.021	0.979	0.044	0.230	0.630	
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.210	1.234	0.038	30.700	0.000	***
	NA	-0.005	0.995	0.040	0.020	0.900	
Savings_Bank_in_Use							
	FALSE		1 (ref)				
	TRUE	0.184	1.202	0.051	13.010	0.000	***
Small_Credits_avail							
	FALSE		1 (ref)				
	TRUE	0.244	1.276	0.039	39.020	0.000	***
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		0.089	1.093	0.049	3.380	0.066	.
n_Older_Siblings[2]		-0.043	0.957	0.066	0.440	0.510	
n_Older_Siblings[3+]		0.038	1.038	0.075	0.250	0.620	
n_Older_SiblingsNA		0.330	1.392	0.044	57.350	0.000	***
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-0.469	0.626	0.271	2.990	0.084	.
Hisclass_5Lower Middle Class		0.268	1.307	0.143	3.520	0.061	.
Hisclass_5Self-employed, Skilled		0.561	1.753	0.105	28.710	0.000	***
Hisclass_5Low/ Unskilled		0.345	1.411	0.108	10.200	0.001	**
Hisclass_5NA		0.033	1.033	0.106	0.100	0.760	

frailty(id)					0.240	0.370	
Interactions							
First_Born_Male:Price_Cycle_Wheat		0.233	1.263	0.313	0.560	0.460	
Gen:Price_Cycle_Wheat		-0.225	0.798	0.290	0.600	0.440	
Fath_Dead1:Price_Cycle_Wheat		0.434	1.543	0.254	2.920	0.087	.
Fath_DeadNA:Price_Cycle_Wheat		0.589	1.802	0.327	3.240	0.072	.
Moth_Dead1:Price_Cycle_Wheat		0.121	1.129	0.274	0.200	0.660	
Moth_DeadNA:Price_Cycle_Wheat		0.263	1.301	0.308	0.730	0.390	
Price_Cycle_Wheat:Savings_Bank_in_Use		0.640	1.896	0.362	3.120	0.077	.
Price_Cycle_Wheat:Small_Credits_avail		0.420	1.522	0.271	2.400	0.120	
Price_Cycle_Wheat:n_Older_Siblings[1]		0.252	1.286	0.353	0.510	0.470	
Price_Cycle_Wheat:n_Older_Siblings[2]		0.512	1.669	0.463	1.230	0.270	
Price_Cycle_Wheat:n_Older_Siblings[3+]		0.357	1.429	0.514	0.480	0.490	
Price_Cycle_Wheat:n_Older_SiblingsNA		0.857	2.356	0.333	6.630	0.010	.
Price_Cycle_Wheat:HisclassElite		-2.825	0.059	1.996	2.000	0.160	
Price_Cycle_Wheat:HisclassLower Middle Class		-3.270	0.038	1.031	10.050	0.002	**
Price_Cycle_Wheat:Hisclass_5Self-employed,Skilled		-2.270	0.103	0.707	10.300	0.001	**
Price_Cycle_Wheat:Hisclass_5Low/Unskilled		-2.315	0.099	0.735	9.920	0.002	**
Price_Cycle_Wheat:Hisclass_5NA		-1.609	0.200	0.720	5.000	0.025	*

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 28 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -38801.4
Degrees of freedom for terms= 1.0 1.0 1.0 2.0 2.0 1.0 1.0 4.0 5.0 0.2 1.0 1.0 2.0 2.0 1.0 1.0 4.0 5.0
Concordance= 0.592 (se = 0.004)
Likelihood ratio test= 567.1 on 35.24 df, p=<2e-16

It should be first mentioned that the effects without interaction change very little. The only exception, and therefore the only variable that really changes to a noteworthy extent, is the Price_Cycle_Wheat variable: whereas the Price_Cycle_Wheat interactions contain years in which wheat prices had increased 10% or more, the Price_Cycle_Wheat variable without interactions now contains only the remaining and thus better or good economic years, explaining the non-visible demographic reaction of the Würseleners to the Price_Cycle_Wheat in the above model (see again 3.3).

Interaction effects, in turn, are in general difficult to determine. In this model, as well as in forthcoming models, they principally indicate that in years of economic stress, one can observe an effect of a certain variable on marriage behaviour. For instance, being a first-born male in years of economic stress has a positive impact on marriage chances in these years compared to the rest of the century. However, the effect remains without any statistical significance and therefore without explanatory power in the above model.

The fact that women do not marry earlier in years of economic stress when compared to their male peers indicates that women wait out economically stressful years longer than men. If both would postpone marriage to the same extent, the age gap shown in Figure 19 should remain rather stable and thus visible in the effects here.

If the father had died during years of economic stress, marriage is more likely than if he had died in better economic years. More resources are needed in economically bad years in order to set up a marriage fund and thus his death could be seen as both a constraint relief on the demand side, as well as a chance to set up a marriage fund with an increase on the supply side through the resources obtained from inheritance, at least for the first-borns.

Older siblings seem to have some positive impact on the marriage behaviour of their younger siblings during years of economic stress. As none of the results are statistically significant here, a more extensive interpretation has to be postponed to the analysis of the three separate periods.

The social strata variable has already shown that during normal years the probability of marrying for the two lower strata of society (skilled and the unskilled workers) and also for the lower middle class is higher than that for the farmers. In contrast, the likelihood for marriage for the elite group is lower than the farmers. Nevertheless, during years of economic stress, both the two upper (elite and lower middle class) and the two lower strata marry less than the farmers, with the results being statistically significant for all groups but the elite group. This lower vulnerability of farmers to short-term economic stress, particularly when compared to the lower strata, is not surprising and can be found already in existing literature (see all EAP volumes, for fertility see Tsuya et al. 2010, pp. 181, 184 for instance). What comes as a surprise, however, is how the upper class reacts to worsening economic conditions in a similar manner as the lower strata. This effect may suggest either a deliberate postponing of marriage by the upper class until the economy stabilises again or a focus of the farmers to marry mainly in years of higher grain prices, as they would profit from these (Bengtsson 2004b, p. 151). However, when splitting the model into the three periods,

according to hypothesis 2, the strata effects are expected to blur and to finally disappear in the later period(s).

The Savings_Banks_in_Use and the Small_credits_avail variables support the effects found under better years, the former being statistically significant, the latter almost statistically significant. So far, it is reasonable to say that bank savings could have had at least some positive influence on enlarging marriage possibilities.

The NA cases with some statistical significance also remain difficult to disentangle here. The results for these cases in the Fath_Death and the n_Older_Siblings variable under economic pressure could point to a higher need of migrating in times of economic stress. The NA group in the Hisclass_5 variable might point to poorer men who wait for better times to marry and to women who on average wait out, indifferent to the good or bad economic situation.

The following will now further break down the full model and disentangle the results found above. The subsequent three result tables provide the calculation results for each of the above established periods respectively, in the same manner as stated above.

Results Table 4: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Model with Interactions, Würselen 1810 – 1839

Number of events = 1061

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		-1.056	0.348	1.250	0.710	0.400	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.235	1.265	0.090	6.870	0.009	***
Gen							
	MALE		1 (ref)				
	FEMALE	-0.265	1.767	0.083	-3.187	0.001	**
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.081	1.084	0.075	1.140	0.280	
	NA	-0.046	0.955	0.100	0.210	0.640	
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.222	1.249	0.080	7.670	0.006	**
	NA	-0.158	0.854	0.100	2.500	0.110	
Savings_Bank_in_Use							
	FALSE		1 (ref)				
	TRUE	0.301	1.351	0.069	19.000	0.000	***
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		0.056	1.058	0.092	0.370	0.540	
n_Older_Siblings[2]		0.142	1.153	0.114	1.550	0.210	
n_Older_Siblings[3+]		0.176	1.193	0.145	1.470	0.220	
n_Older_SiblingsNA		0.265	1.303	0.123	4.590	0.032	*
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-14.858	0.000	1782.000	0.000	0.990	
Hisclass_5Lower Middle Class		0.163	1.177	0.283	0.330	0.560	
Hisclass_5Self-employed,Skilled		0.358	1.430	0.164	4.770	0.029	*
Hisclass_5Low/Unskilled		0.086	1.090	0.171	0.260	0.610	
Hisclass_5NA		-0.357	0.700	0.168	4.520	0.033	*
frailty(id)					0.050	0.560	
Interactions							

First_Born_Male:Price_Cycle_Wheat	0.709	2.032	0.618	1.320	0.250	
Gen:Price_Cycle_Wheat	-0.196	0.822	0.570	0.120	0.730	
Fath_Dead1:Price_Cycle_Wheat	0.289	1.335	0.524	0.300	0.580	
Fath_DeadNA:Price_Cycle_Wheat	1.180	3.255	0.686	2.960	0.085	.
Moth_Dead1:Price_Cycle_Wheat	0.207	1.230	0.556	0.140	0.710	
Moth_DeadNA:Price_Cycle_Wheat	-0.198	0.821	0.694	0.080	0.780	
Savings_Bank_in_Use:Price_Cycle_Wheat	1.402	4.062	0.476	8.680	0.003	**
n_Older_Siblings[1]:Price_Cycle_Wheat	1.316	3.728	0.639	4.240	0.039	*
n_Older_Siblings[2]:Price_Cycle_Wheat	1.248	3.484	0.807	2.400	0.120	
n_Older_Siblings[3+]:Price_Cycle_Wheat	0.873	2.394	1.033	0.710	0.400	
n_Older_SiblingsNA:Price_Cycle_Wheat	2.298	9.955	0.869	6.990	0.008	**
Hisclass_5Elite:Price_Cycle_Wheat	-0.660	0.517	13690.000	0.000	1.000	
Hisclass_5Lower Middle Class:Price_Cycle_Wheat	-1.136	0.321	1.931	0.350	0.560	
Hisclass_5Self-employed,Skilled:Price_Cycle_Wheat	-1.490	0.225	1.136	1.720	0.190	
Hisclass_5Low/Unskilled:Price_Cycle_Wheat	-0.807	0.446	1.180	0.470	0.490	
Hisclass_5NA:Price_Cycle_Wheat	-1.379	0.252	1.160	1.410	0.230	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 33 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -7136.3
Degrees of freedom for terms= 1.0 1.0 1.0 2.0 2.0 1.0 4.0 5.0 0.1 1.0 1.0 2.0 2.0 1.0 4.0 5.0
Concordance= 0.605 (se = 0.01)
Likelihood ratio test= 151.7 on 33.05 df, p=0

Results Table 5: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Model with Interactions, Würselen 1840 – 1869

Number of events = 1582

		Coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		0.637	1.891	1.156	0.300	0.580	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.208	1.231	0.075	7.690	0.006	**
Gen							
	MALE		1 (ref)				

	FEMALE	0.420	1.343	0.072	34.010	0.000	***
Fath_Dead							
	FALSE		1 (refe)				
	TRUE	0.168	1.183	0.059	8.210	0.004	**
	NA	-0.095	0.910	0.082	1.350	0.250	
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.136	1.146	0.063	4.710	0.030	*
	NA	-0.274	0.761	0.081	11.470	0.001	**
Small_Credits_avail							
	FALSE		1 (ref)				
	TRUE	0.144	1.155	0.054	6.980	0.008	**
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		0.105	1.111	0.079	1.780	0.180	
n_Older_Siblings[2]		-0.246	0.782	0.109	5.100	0.024	*
n_Older_Siblings[3+]		-0.167	0.846	0.122	1.870	0.170	
n_Older_SiblingsNA		0.266	1.305	0.083	10.210	0.001	**
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-0.676	0.509	0.487	1.930	0.170	
Hisclass_5Lower Middle Class		0.539	1.714	0.234	5.310	0.021	*
Hisclass_5Self-employed,Skilled		0.639	1.895	0.175	13.290	0.000	***
Hisclass_5Low/Unskilled		0.332	1.394	0.185	3.220	0.073	.
Hisclass_5NA		0.031	1.031	0.179	0.030	0.860	
frailty(id)					0.080	0.510	
Interactions							
First_Born_Male:Price_Cycle_Wheat		0.557	1.746	0.483	1.330	0.250	
Gen:Price_Cycle_Wheat		0.385	1.470	0.456	0.710	0.400	
Fath_Dead1:Price_Cycle_Wheat		0.286	1.332	0.365	0.620	0.430	
Fath_DeadNA:Price_Cycle_Wheat		0.397	1.487	0.516	0.590	0.440	
Moth_Dead1:Price_Cycle_Wheat		0.364	1.439	0.389	0.870	0.350	
Moth_DeadNA:Price_Cycle_Wheat		0.415	1.515	0.509	0.670	0.410	
Small_Credits_avail:Price_Cycle_Wheat		0.337	1.401	0.358	0.890	0.350	
n_Older_Siblings[1]:Price_Cycle_Wheat		0.689	1.992	0.507	1.850	0.170	

n_Older_Siblings[2]:Price_Cycle_Wheat	0.861	2.365	0.687	1.570	0.210	
n_Older_Siblings[3+]:Price_Cycle_Wheat	-0.038	0.962	0.769	0.000	0.960	
n_Older_SiblingsNA:Price_Cycle_Wheat	1.331	3.786	0.518	6.620	0.010	*
Hisclass_5Elite:Price_Cycle_Wheat	-1.169	0.311	2.830	0.170	0.680	
Hisclass_5Lower Middle Class:Price_Cycle_Wheat	-3.266	0.038	1.429	5.220	0.022	*
Hisclass_5Self-employed,Skilled:Price_Cycle_Wheat	-3.015	0.049	1.032	8.530	0.004	**
Hisclass_5Low/Unskilled:Price_Cycle_Wheat	-3.152	0.043	1.102	8.170	0.004	**
Hisclass_5NA:Price_Cycle_Wheat	-2.105	0.122	1.059	3.950	0.047	*

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 27 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -11177.1
Degrees of freedom for terms= 1.0 1.0 1.0 2.0 2.0 1.0 4.0 5.0 0.1 1.0 1.0 2.0 2.0 1.0 4.0
Concordance= 0.601 (se = 0.008)
Likelihood ratio test= 211.5 on 33.08 df, p=0

Results Table 6: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Model with Interactions, Würselen 1870 – 1899

Number of events = 2163

		Coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		2.489	12.053	1.999	1.550	0.210	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.076	1.079	0.060	1.620	0.200	
Gen							
	MALE		1 (ref)				
	FEMALE	0.226	1.254	0.058	15.340	0.000	***
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.140	1.150	0.053	7.070	0.008	**
	NA	0.059	1.061	0.061	0.940	0.330	
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.277	1.320	0.060	21.520	0.000	***
	NA	0.108	1.114	0.055	3.920	0.048	*
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				

n_Older_Siblings[1]	-0.038	0.963	0.081	0.220	0.640	
n_Older_Siblings[2]	-0.352	0.703	0.159	4.900	0.027	*
n_Older_Siblings[3+]	-0.545	0.580	0.242	5.080	0.024	*
n_Older_SiblingsNA	0.347	1.415	0.057	37.660	0.000	***
HISCLASS						
Hisclass_5Farmers		1 (ref)				
Hisclass_5Elite	0.101	1.106	0.399	0.060	0.800	
Hisclass_5Lower Middle Class	0.394	1.483	0.284	1.920	0.170	
Hisclass_5Self-employed,Skilled	0.862	2.369	0.241	12.770	0.000	***
Hisclass_5Low/Unskilled	0.742	2.100	0.244	9.260	0.002	**
Hisclass_5NA	0.524	1.689	0.243	4.660	0.031	*
frailty(id)				0.000	0.830	
Interactions						
First_Born_Male:Price_Cycle_Wheat	0.050	1.052	0.569	0.010	0.930	
Gen:Price_Cycle_Wheat	0.629	1.876	0.551	1.300	0.250	
Fath_Dead1:Price_Cycle_Wheat	0.785	2.192	0.508	2.390	0.120	
Fath_DeadNA:Price_Cycle_Wheat	0.435	1.545	0.583	0.560	0.460	
Moth_Dead1:Price_Cycle_Wheat	-0.471	0.624	0.576	0.670	0.410	
Moth_DeadNA:Price_Cycle_Wheat	-0.113	0.893	0.522	0.050	0.830	
n_Older_Siblings[1]:Price_Cycle_Wheat	0.767	2.153	0.794	0.930	0.330	
n_Older_Siblings[2]:Price_Cycle_Wheat	-0.728	0.483	1.568	0.220	0.640	
n_Older_Siblings[3+]:Price_Cycle_Wheat	0.633	1.883	2.266	0.080	0.780	
n_Older_SiblingsNA:Price_Cycle_Wheat	0.286	1.331	0.528	0.290	0.590	
Hisclass_5Elite:Price_Cycle_Wheat	-6.318	0.002	3.407	3.440	0.064	.
Hisclass_5Lower Middle Class:Price_Cycle_Wheat	-5.927	0.003	2.445	5.880	0.015	*
Hisclass_5Self-employed,Skilled:Price_Cycle_Wheat	-2.856	0.058	1.934	2.180	0.140	
Hisclass_5Low/Unskilled:Price_Cycle_Wheat	-3.848	0.021	1.963	3.840	0.050	.
Hisclass_5NA:Price_Cycle_Wheat	-2.026	0.132	1.946	1.080	0.300	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 6 outer, 32 Newton-Raphson
Variance of random effect= 5e-07 I-likelihood = -15324.1
Degrees of freedom for terms= 1 1 1 2 2 4 5 0 1 1 2 2 4 5
Concordance= 0.577 (se = 0.007)
Likelihood ratio test= 190.3 on 31 df, p=0

Again, the first variable to be discussed will be the Price_Cylce_Wheat variable. As with the full model with interaction effects, the effects of this variable are not statistically significant for any of the three periods. Against expectations, the Würseleners do not delay marriages during better years.

Being a first-born male only remains an advantage for early marriage during the first two periods of the century. The positive effect of being a first-born under economic stress in the first period decreases throughout the century, until this advantage completely disappears in the last period. In line with Dillon's findings for Quebec, but contrary to Bras and Kok´s findings for the northwestern Netherlands (Bras and Kok 2016), first-born males in Würselen have a "systematic advantage" that give them more "substantial opportunities" (Dillon 2010, p. 172) to marry, mainly due to inheritance practices that favour them. The results are also similar to Susanet and Bras's conclusions (Suanet and Bras 2014, p. 136). During the first two periods, thus, there are signs of families favouring their first-born sons, who receive either the full or at least the largest share of the parental property, allowing them to marry more frequently in better years and to navigate through crises better (see again Bracht 2013 chapter 3.2: farmland as necessity for production and an asset for savings; Fertig 2009, p. 503: farmland as a strong argument for obtaining loans and even cheap loans; Bengtsson et al. 2004; subchapters 4.2.1, 4.2.2, 4.2.5). Actual inheritance laws, namely French laws that guarantee the equal division of property since 1794 as elaborated under 4.2.1, and actual inheritance practices differ in the first two periods of the century.[54] The stem family common in Würselen ultimately determines how succession and inheritance are organised in these years (Todd 1996[1990], p. 74). It is likely that the French inheritance system of equal shares of property was gradually, and only towards the end of the century, absorbed into the inheritance practices of the Würseleners, thus reducing the first-born males' advantage to marry. This idea is further supported by Fertig and Fertig's case study on Westphalia (Fertig and Fertig 2006, p. 185).

As in the full model, women marry earlier than men during normal years. The rather equal distribution of the share of men and women included in the research provides no alternative explanation for why women marry more often other than their favourable position on the marriage

[54] See also Fertig and Fertig 2006, p. 185 for examples of diverging inheritance laws and practices in Westphalia, Germany.

market. The so-far-uncontested evidence that women do not marry earlier than men in years of economic stress throughout the century indicates that women wait outeconomically stressful years somewhat longer.

The death of parents also has a strong influence. However, only during the last two periods does the death of the father have a significant effect. This is particularly noticeable during the period from 1869-1899 when there is a strong positive and nearly statistically significant effect of the death of the father under economic stress. This gradual rise of importance of the father´s death towards the end of the century, however, cannot be explained neither by a possible niche principle (Hajnal 1965; Bras and Kok 2016), nor by conceiving marriage as a compensation for the loss of the male breadwinner (Voland and Willführ 2017). Indeed, these two explanations would rather suggest a decreasing importance of the father's death: both the French inheritance system, resulting in the disappearance of a potential niche principle, as well as rising real wages should arguably make it easier to deal with an alive father, not harder. Therefore, the increasing significance of the father´s death leads more towards an explanation that relates to caretaking in old age and related resource binding. The rising life expectancy particularly for men towards the end of the century (Marschalck 1984, pp. 167ff; Ehmer 2013, p. 37) results in an extended and therefore costly caretaking period. At the event of a father's death, the necessary resources of both money and time can then be redirected into a sufficient marriage fund and establishing a separate family/ household.

The effects of the death of the mother remain rather stable throughout the century and are very much comparable to the full model. In better years, the death of the mother has strong positive effects throughout the century, also indicating obligations to take care for the aged mother. Ageing parents generally can be considered as a potential heavy burden (McCormick 2011, pp. 27f), particularly as caretaking cannot be "outsourced". Life expectancy is rising for women too but as the expectancy was higher from the beginning, higher caretaking costs can be expected from early on in the century, explaining the respective effects already in the first period under research. When the mother dies, the chances of marrying increases. During years of economic stress in the first period, the death of the mother also makes marrying somewhat easier, probably due to the same explanation. Taking the findings for mothers and fathers together, the caretaking argument seems to be the most plausible to explain the effects of parental deaths, which is also in line with the lifecycle of a family as established in the literature review (Bouman et al. 2012, p. 10; see again

figure 2). In an EMP area of late marriages, it seems reasonable to assume that the caretaking of the parents starts exactly when the bulk of individuals would like to marry.[55] Accepting thus this caretaking argument as the main one for higher chances of marriage after the death of the parents, the ties of the closest family members, parents and children, should be considered to remain strong throughout the century in Würselen. While there are some signs at the end of the century of a weakening of these ties and of the caretaking of the mother, the effects are not yet visible on the father´s side, suggesting no signs of a decreasing authority of the head of the family either, despite slow but steady changes in inheritance practices.

The effects for the parents' death do not directly influence the effects of the relationship among siblings. The longer the century lasts, the more visible the disadvantages of having older sibling for marrying in better years become. Especially in the last period, 1869-1899, older siblings hinder younger siblings´ marriage chances. This is supported by the fact that there is a clear advantage of having older siblings during years of economic stress in the early period, which reduces to a small advantage in the middle period, which then finally diminishes to no advantage in the last period. A shift from supportive older siblings to non-supportive older siblings also becomes apparent. The causes, however, remain ambivalent and are characterised by simultaneous cooperation and competition as found by Voland and Willführ (Voland and Willführ 2017, p. 134). Namely, while older siblings tend to be competitors for resources in better years, making it harder for their younger siblings to marry, they simultaneously tend to be helpers during years of economic stress. Possibilities for the ego´s "cash flow juggling" (see again Deneweth et al. 2014, p. 89) through informal moneylending as established under 4.2.5 would be a major advantage and explanation for the latter.

The social strata variable shows only few differences to the full model. During better years, the chances of marring for the two lower strata of society (skilled and the unskilled workers) is constantly higher than for farmers. While the effects for the elite group cannot be proven or disproven, the lower middle class generally follows this path, though without lacking statistical significance for the first and the last period. During years of economic stress, instead, both the two upper (elite and lower middle class) and the two lower strata marry less than the farmers during

[55] Remember also that the physical and mental status of a 60-year-old parent in the 19th century is not comparable to a today's 60-year-old parent due to the significantly harder life conditions (see again chapter IV).

the last two periods. The effects are similar for the first period but the sometimes small number of cases for certain Hisclass_5 groups might not allow for statistical significance here. In any case, as already found in the full model with interaction effects, this lower vulnerability of farmers to short-term economic stress is particularly common and not surprising as explained above. What is surprising, however, is that although the vulnerability to short term economic stress is somewhat decreasing, it has not disappeared for the Würseleners by the end of the century. This is despite accelerating industrialisation and increasing institutions that attenuate economic stress, as elaborated in chapter IV.

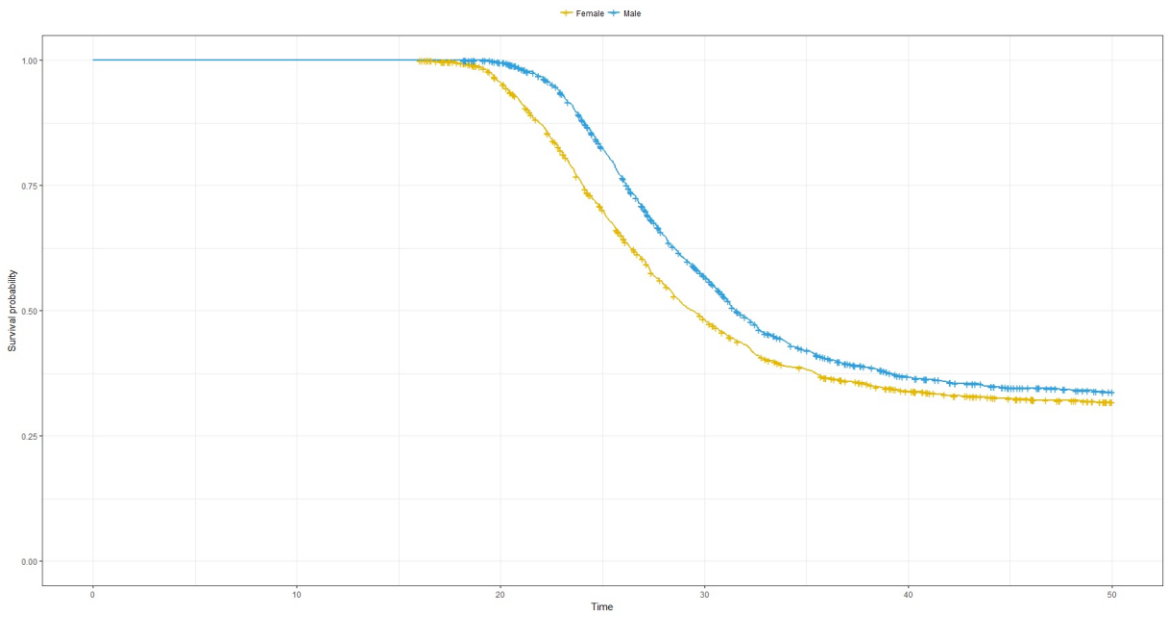
Moreover, the NA cases also show some change, particularly in the last period where fewer effects are found. Especially migrants would profit from the booming industry during the last third of the century.

5.2 Meerssen

5.2.1 Descriptive Statistics Meerssen

When now turning to Meerssen, let us proceed in the same way as for Würselen and begin with the probability distribution for not marrying as established above:

Figure 20: Probabilities of Not Marrying in Meerssen 1810 – 1899



Source: Familienbuch Euregio, own calculations and illustration

Figure 20[56] shows two main differences when compared to Würselen. First, the share of around 32% who appear to not experience an event is higher here. Following van der Walle's figures of those who never marrieds for Limburg in 1870 (van der Walle 1968, p. 496) and Engelen and Kok's figures for Limburg and Brabant in the early 20th century (Engelen and Kok 2003, Table 1), a sound estimation should lie at around 12-14% of the population.[57] The figures calculated through the Knodel and Maynes method reveal a share of 20.3% permanent celibacy/ never married

[56] See also figures 26 and 27 in the appendix for further insights of descriptive marriage behaviour with slightly changing parameters.

[57] The higher estimation of van der Walle are the result of excluding men from the analysis. Men have lower celibacy rates and would somewhat lower the share of those who never married.

(Familienbuch Euregio), which are indeed higher than the expected estimates and the figures for Würselen.

Table 34: Deceased and Never Married in Meerssen 1800-1899

	1800 - 1899					
	M	Share	F	Share	Total	Share
Deceased	2071		1821		3892	
Deceased 45 - 49 years	42	100.0%	32	100.0 %	74	100.0%
Deceased 45 - 49 years not married	9	21.4%	6	18.8%	15	20.3%

Source: Familienbuch Euregio

However, taking into account the very small number of cases here, this result is not very robust as it only includes 15 individuals who died between 45 and 49 and who haven't married.

The second difference with Würselen is that the risk of not marrying decreases over time. The negative slope of the curve only becomes less pronounced at about 31/ 32 years of survival time, which is about a year or two later than in Würselen. This difference is further explained when comparing the ages at marriage:

Table 35: Mean Age of First Marriage and Age Differences of Partners in Meerssen 1810 – 1899

	Mean Age of first Marriage			
Period	**Total**	**Men**	**Women**	**Age Difference**
1810	30.1	31.1	29.1	2.0
1820	27.6	28.5	26.6	1.9
1830	28.6	29.3	28.0	1.2
1840	28.8	29.6	27.9	1.7
1850	28.1	29.1	27.2	1.9
1860	28.3	29.2	27.5	1.6
1870	27.0	28.2	25.8	2.4
1880	27.4	28.1	26.7	1.4
1890	26.7	27.9	25.5	2.4
Mean	28.1	29.0	27.1	1.8

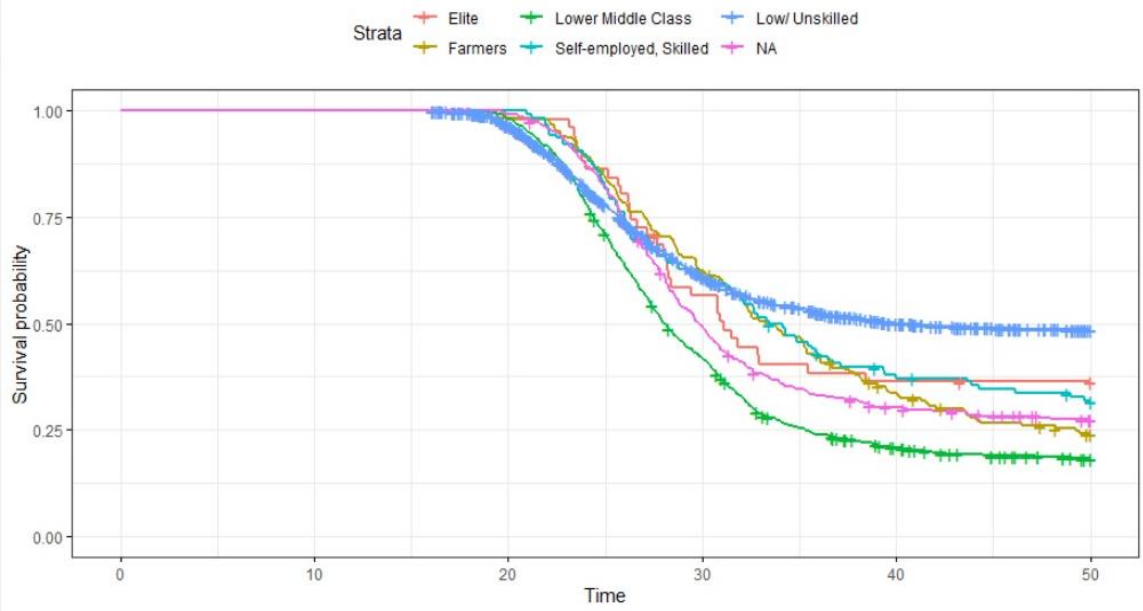
Source: Familienbuch Euregio, own calculations

Other than for Würselen, the mean age of marriage decreases almost constantly throughout the century, namely from 30.1 years to 26.7 years. This is a remarkable decrease of 3.4 years. The highest age at marriage for both men and women are found between 1810-1820, which drops rather dramatically in the next decade. The lowest marriage age is found at the very end of the century. The mean age of marriage throughout the century is 1.5 years higher for the Meersseners when compared to the Würseleners, explaining why the curve of not marrying in figure 20 decreases less steeply. The above figures point to stronger marriage constraints particularly at the beginning of the century, which then decrease remarkably towards its end. This is different to Würselen where the lowest age of marriage was found at the beginning and at the end of the century. Until and during the 1860s, Meerssen men marry later than their peers in Würselen. The last three decades are then almost identical and are similar for women too. Age differences of the partners circle around 2 years with only a few exceptions (such as during the 1830s and 1880s). In comparison to Würselen, age differences of the partners are during the first half of the century somewhat higher for Meerssen. However, this then becomes similar for two communes from the 1860 onwards, when the age difference becomes less pronounced in Meerssen. These comparable age differences of the partners further point towards similar levels of patriarchy, which in turn would further

support Todd´s findings on similar family types in Limburg and the district of Aachen. In total, however, there is more change in Meerssen than in the rather stable behaviour of the Würseleners. The "Proportion of young brides", 0.03, is similar to Würselen, while the "Proportion of older wives", 0.37, is slightly higher in Meerssen. This ultimately points to a less pronounced patriarchy in the latter commune.

How are the chances for marriages distributed among the different social classes?

Figure 21: Probabilities of Not Marrying in Meerssen 1810 – 1899 by Social Classes



Source: Familienbuch Euregio, own calculations and illustration

Striking differences to Würselen are found between the lowest classes of society. As would normally be expected, here the low/unskilled have the lowest chances to marry. However, farmers instead have rather good chances to marry, pointing towards a less-pronounced niche principle. While the lower middle class similarly has the best chances to marry, the NA cases group is rather average here. It might be that this group is somewhat more heterogenous then in Würselen.

As with Würselen, let us now move on to the description of the statistical model for Meerssen that is applied for further statistical analyses. The model for Meerssen is very similar to that of Würselen as the comparability of the models is key for the present analysis:

Table 36: Means and Frequencies of the Variables Used in the Modelling of First Marriages in Meerssen 1810 – 1899

Price_Cycle_Wheat (t-1)	Mean	Standard Deviation					
	0	0.14					
First_Born_Male	No	Yes					Sum
Number	3442	366					3808
%	90.39	9.61					100
Gen	Male	Female					Sum
Number	1949	1859					3808
%	51.2	48.8					100
Fath_Dead	No	Yes	NA				Sum*
Number	2036	1012	1388				4436
%	45.9	22.8	31.3				100
Moth_Dead	No	Yes	NA				Sum*
Number	2129	749	1435				4313
%	49.4	17.4	33.3				100
n_Older_Siblings	0	1	2	3+	NA		Sum*
Number	2267	872	448	291	238		4116
%	55.1	21.2	10.9	7.1	5.8		100
Hisclass_5	Elite	Lower Middle Class	Self-employed, Skilled	Farmers	Low/ Unskilled	NA	Sum
Number	51	126	447	186	1303	1695	3808
%	1.3	3.3	11.7	4.9	34.2	44.5	100

*Double-countings from time-variation resulting in changing spells. Changing spells added to n=3808
Source: Tijms 1983, Familienbuch Euregio, own calculations

A major difference to Würselen is half as many cases are observed. This may result in the findings overall being less robust for the Meerssen models. This problem, however, would mainly affect the first period, 1810-1839, which has only 379 events for Meerssen compared to 1045 for Würselen. In order to prevent this, the first two periods for Meerssen will be in a summarised model. In doing so, this summarised model will account for 1134 events to be analysed in order to provide results that are statistically significant and interpretable.

The first-born males constitute 9.61% of the sample. For 16.7% of the males, the birth order is unknown and thus higher than the figure for Würselen, also explaining both the slightly lower share of first-born males in the population and the less successful linking of siblings in the n_Older_Siblings group.

In the Meerssen sample there are more men than women. But the very marginal difference of 1.2% should only slightly affect the results, probably slightly favouring women to marry as they have more choice and thus a higher chance to find suitable marriage partners (see again 3.5). When compared to Würselen, the share of NA cases is a little higher for the Fath_Dead and Moth_Dead variables. This is explained by the fact that Meerssen is only assignable as birthplace to a slight majority here, just above 50%, which possibly points to relatively more migrants in Meerssen. For Würselen this was 78.8%. This figure will later also be important when comparing the strength of family ties as indicated in chapter 2.2. This is because migrants probably have looser ties to their families and therefore may be themselves an indicator of weak family ties, resulting in a higher vulnerability to economic stress due to lack of social capital.

Some differences are found for n_Older_Siblings variables, mainly in the NA group. The lower share of NAs in Meerssen could point to a somewhat more complete linking of the wiewaswie data when compared to the Familienbuch. Another difference is the considerably lower share of NAs for Hisclass_5, due to reasons already stated in sub-chapter 4.2.4. However, overall, the statistical density of the data for both communes appears to be rather similar. The calculation results will reveal further possibilities for interpretation:

5.2.2 Results Meerssen

Results Table 7: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Full Model without Interactions, Meerssen 1810 – 1899

Individuals 3808, number of events = 2340

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		-0.235	0.791	0.159	2.190	0.140	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.035	1.035	0.060	0.340	0.560	
Gen							
	MALE		1 (ref)				
	FEMALE	0.153	1.166	0.046	11.280	0.001	**
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	-0.031	0.969	0.061	0.260	0.610	
	NA	0.238	1.269	0.066	13.020	0.000	***
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	-0.001	0.999	0.068	0.000	0.990	
	NA	-0.024	0.976	0.065	0.140	0.710	
Savings_Bank_in_Use							
	FALSE		1 (ref)				
	TRUE	0.088	1.092	0.061	2.040	0.150	
Small_Credits_avail							
	FALSE		1 (ref)				
	TRUE	0.255	1.290	0.056	20.530	0.000	***
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		-0.147	0.864	0.068	4.670	0.031	*
n_Older_Siblings[2]		-0.263	0.768	0.090	8.570	0.003	**
n_Older_Siblings[3+]		-0.275	0.760	0.102	7.330	0.007	**
n_Older_SiblingsNA		0.257	1.293	0.081	10.030	0.002	**
HISCLASS							
Hisclass_5Farmers			1 (ref)				

Hisclass_5Elite		-0.165	0.848	0.198	0.690	0.400	
Hisclass_5Lower Middle Class		-0.269	0.764	0.143	3.570	0.059	.
Hisclass_5Self-employed, Skilled		0.096	1.101	0.105	0.840	0.360	
Hisclass_5Low/ Unskilled		0.165	1.180	0.095	3.020	0.082	.
Hisclass_5NA		-0.521	0.594	0.099	27.570	0.000	***
frailty(id)					0.120	0.460	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 28 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -17535.6
Degrees of freedom for terms= 1.0 1.0 1.0 2.0 2.0 1.0 1.0 4.0 5.0 0.1
Concordance= 0.607 (se = 0.006)
Likelihood ratio test= 372.9 on 18.12 df, p=<2e-16

To begin with an overview on the frame of the models for Meerssen, both the sample and the number of its marriage events is about half the size of those in Würselen. Nevertheless, the size of the sample with 3808 individuals and 2340 events still reveals clear result and is suitable for comparison. The p-values indicate stable results that are overall only minimally less robust than those for Würselen, if at all.

The full model without interaction effects for Meerssen shows no statistical significance for t-1 reactions to rising wheat prices. However, with the effect pointing towards a delay of marriage and a p-value just above the still commonly accepted 0.1, finding vulnerability to economic stress is possible when further dividing the periods.

The First_Born_Male variable shows no effects at all. When looking at the 19th century as a whole, for first-born males have no advantage for earlier marriage in Meerssen. Further comments on these findings will therefore be postponed until the periods are divided.

Not surprisingly, as already seen above, women generally marry earlier than men. As the effect is not considerably larger than for Würselen, the rather small difference between men and women in the sample results indicate no additional effects on the likelihood of marriage.

Almost no effects are found on this model caused by the death of the parents. Regarding the positive effect of the NA cases for the death of the father, it could be speculated that an alive father could have some positive influence on marriage possibilities during the 19th century in Meerssen. This would be opposite to Würselen. However, as described above, one cannot simply assume that the majority of these NA cases stand for alive fathers, meaning this finding must remain a speculation only. No effects are found for the death of the mother. Therefore, the idea that her death

leads to a necessary substitution of an important share of the families´ income through marriage, as established under 3.5, does not hold here. Instead, it is likely that the above-mentioned explanation about caretaking for parents in old age is again much more convincing. As elaborated in the reconstruction of the historical context section in chapter IV, Meerssen by far has developed the best supportive institutions for the elderly and the needy. From as far as outside Limburg, people would bring their relatives to Meerssen to be taken care of due to the favourable conditions (Rutten 1995, p. 126). The caretaking of elderly parents could be outsourced in Meerssen, therefore relieving pressure on the young couple and reducing the importance of the death of the parents. In combination with the reduced advantages of being a first-born, this finding also indicates lower patriarchy levels than in Würselen.

The presence of older siblings does instead have an impact on the marriage behaviour of the Meersseners. Those with no older siblings clearly marry earlier than those who do. Resource dilution (Bras et al. 2010; Kok et al. 2011; Öberg 2017) and more competition than cooperation (see again Voland and Willführ 2017, p. 134) seem to be more of an issue in Meerssen than in Würselen. Taking this finding together with the outsourcing of caretaking for elderly parents, family ties between the closest family members appear to be weaker in Meerssen. The cultural norm of the youngest son/ daughter expected to assist the parents in old age might also be an issue here. Indeed, marriage is most delayed for those with the most siblings.

The Hisclass_5 group also behaves differently. While in Würselen only the elite group marries later than the farmers in the full model without interaction effects, in Meerssen both the upper strata, elite and lower middle class marry later. An explanation might be found in Therborn´s argument of pioneers, followers, and late-comers to explain the transition in European fertility. Therborn defines pioneers as social groups with high levels of agency. He holds that their reduced fertility rate is a consequence of rational reasons, as they believe that fewer children bring at least some advantages. Followers, whose motivation to imitate this behaviour increases because of compulsory education, then imitate the behaviour of the pioneers, albeit with a delay. The late-comers, groups in which both the economy as well as demographics would be (still) stagnant or in opposition to change, would resist the occurring change in birth rates as long as possible (cf. Therborn 2004, pp. 240, 290f). Following this argument, it is plausible to assume that the lower middle class in Meerssen has already followed the elite group who have already reduced overall fertility by rationally delaying marriages. In comparison, such a development that has not (yet)

taken place in Würselen. This development suggests that the Meerssener society is somewhat more adaptive to the changes brought by industrialisation. The lower strata, however, follows the results obtained for Würselen, though without any statistical significance for the group of self-employed and skilled workers in this full model. In order to prepare a more profound analysis, let us now turn to the full model complemented by interactions of the above-analysed variables with wheat prices.

Results Table 8: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Full Model with Interactions, Meerssen 1810 – 1899

Individuals 3808, number of events = 2340

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		-0.177	0.838	0.759	0.050	0.820	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.037	1.038	0.060	0.390	0.530	
Gen							
	MALE		1 (ref)				
	FEMALE	0.155	1.167	0.046	11.480	0.001	**
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	-0.033	0.968	0.061	0.290	0.590	
	NA	0.237	1.268	0.066	12.880	0.000	***
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.000	1.000	0.068	0.000	1.000	
	NA	-0.022	0.979	0.065	0.110	0.740	
Savings_Bank_in_Use							
	FALSE		1 (ref)				
	TRUE	0.096	1.101	0.062	2.410	0.120	
Small_Credits_avail							
	FALSE		1 (ref)				
	TRUE	0.255	1.291	0.056	20.570	0.000	***
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		-0.144	0.866	0.068	4.520	0.034	*
n_Older_Siblings[2]		-0.262	0.770	0.090	8.430	0.004	**

n_Older_Siblings[3+]	-0.273	0.761	0.102	7.220	0.007	**
n_Older_SiblingsNA	0.258	1.295	0.081	10.110	0.002	**
HISCLASS						
Hisclass_5Farmers		1 (ref)				
Hisclass_5Elite	-0.195	0.823	0.203	0.920	0.340	
Hisclass_5Lower Middle Class	-0.268	0.765	0.143	3.520	0.061	.
Hisclass_5Self-employed, Skilled	0.095	1.100	0.105	0.820	0.360	
Hisclass_5Low/ Unskilled	0.169	1.184	0.095	3.130	0.077	.
Hisclass_5NA	-0.521	0.594	0.100	27.430	0.000	***
frailty(id)				0.120	0.460	
Interactions						
First_Born_Male:Price_Cycle_Wheat	0.453	1.574	0.460	0.970	0.320	
Gen:Price_Cycle_Wheat	0.106	1.111	0.346	0.090	0.760	
Fath_Dead1:Price_Cycle_Wheat	0.608	1.838	0.463	1.730	0.190	
Fath_DeadNA:Price_Cycle_Wheat	-0.120	0.887	0.508	0.060	0.810	
Moth_Dead1:Price_Cycle_Wheat	0.151	1.164	0.505	0.090	0.760	
Moth_DeadNA:Price_Cycle_Wheat	0.611	1.843	0.500	1.500	0.220	
Savings_Bank_in_Use:Price_Cycle_Wheat	-0.012	0.989	0.394	0.000	0.980	
Price_Cycle_Wheat:Small_Credits_avail	0.713	2.040	0.398	3.210	0.073	.
Price_Cycle_Wheat:n_Older_Siblings[1]	0.593	1.810	0.516	1.320	0.250	
Price_Cycle_Wheat:n_Older_Siblings[2]	0.380	1.463	0.691	0.300	0.580	
Price_Cycle_Wheat:n_Older_Siblings[3+]	0.881	2.414	0.773	1.300	0.250	
Price_Cycle_Wheat:n_Older_SiblingsNA	1.041	2.832	0.641	2.640	0.100	
Price_Cycle_Wheat:HisclassElite	-2.881	0.056	1.641	3.080	0.079	.
Price_Cycle_Wheat:HisclassLower Middle Class	-1.011	0.364	1.081	0.870	0.350	
Price_Cycle_Wheat:Hisclass_5Self-employed,Skilled	-1.324	0.266	0.775	2.920	0.087	.
Price_Cycle_Wheat:Hisclass_5Low/Unskilled	-0.906	0.404	0.690	1.730	0.190	
Price_Cycle_Wheat:Hisclass_5NA	-1.319	0.268	0.726	3.300	0.069	.

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 28 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -17527.6
Degrees of freedom for terms= 1.0 1.0 1.0 2.0 2.0 1.0 1.0 4.0 5.0 0.1 1.0 1.0 2.0 2.0 1.0 1.0 4.0 5.0
Concordance= 0.609 (se = 0.006)
Likelihood ratio test= 389 on 35.12 df, p=<2e-16

The results for variables without interaction effects change only very little in the full model. The change of values for the Price_Cycle_Wheat variable is very much comparable to that of Würselen. In comparison to Würselen, the results for interaction effects are less abundant. For the full model, however, this cannot be explained through the lower number of individuals and cases. While the population of Meerssen is smaller, the data entry in the Familienbuch Euregio is almost as complete as it is for Würselen. It might be that there are simply less effects for Meerssen and hence less vulnerability. These are findings that then will have to be further explained once the periods are separated.

As indicated above, no effects are found for the first-born males so far. Separating periods might also reveal more results here.

The gender effect remains similar to Würselen, also in times of economic stress. Women do not marry earlier than men in bad years, meaning that women wait out economically stressful years more than men.

The death of parents in years of economic stress has no statistically significant effects in Meerssen. While the death of the father under economic stress causes earlier marriages in Würselen, with a similar tendency in Meerssen, there is less statistical significance in the model of the latter. The mother´s death instead has little impact on marriage behaviour, neither in better years nor in years of economic stress. At first glance, when comparing Meerssen compared to Würselen it seems that for the entire century the former places less importance on the family, such as on inheritance practices, patriarchy, and inner-familial caretaking in old age. Weaker family ties in Meerssen might not result in family members determining marriage behaviour neither in better nor in bad years to the same extent as in Würselen.

This idea is supported by the effects of older siblings: while individuals with older siblings delay their marriage in better years, older siblings are also of no help during years of economic stress. Having older siblings in Meerssen in the 19th century hinders marriage more than in Würselen, again pointing towards weaker family ties.

Very similar effects for both communes are found instead with reactions to economic stress in the Hisclass_5 group. In Meerssen all strata of society also delay their marriage when compared to the farmers. Statistical significance and effect size, however, are less pronounced here.

The savings banks and the small credits variables show some positive effects for normal years, whereas the small credits variable also shows a similar tendency in years of economic stress.

In order to now further examine and (dis)prove these findings, it is necessary to continue separating the full model. As indicated above, separating the full model into three parts revealed somewhat unstable models and sometimes no interaction effects at all, particularly for the first period. As a result, it was decided to summarise the first two periods. Now, the models still reveal fewer effects of the respective variables when compared to Würselen, but the overall p-values are highly significant, and the number of cases is additionally large enough to make the results valid and interpretable.

The NA cases of all groups here largely follow the picture of Würselen, both in times of economic ease as well as under economic stress.

Results Table 9: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Model with Interactions, Meerssen 1810 – 1869

Number of events = 1134

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		0.514	1.672	0.853	0.360	0.550	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.021	1.022	0.087	0.060	0.810	
Gen							
	MALE		1 (ref)				
	FEMALE	0.126	1.135	0.065	3.780	0.052	.
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.127	1.135	0.088	2.100	0.150	
	NA	0.273	1.313	0.099	7.610	0.006	**
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.043	1.044	0.094	0.210	0.650	
	NA	-0.090	0.914	0.098	0.830	0.360	
Savings_Bank_in_Use							
	FALSE		1 (ref)				
	TRUE	0.006	1.006	0.063	0.010	0.920	
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		-0.099	0.906	0.095	1.080	0.300	

n_Older_Siblings[2]	-0.191	0.826	0.127	2.280	0.130	
n_Older_Siblings[3+]	-0.370	0.691	0.162	5.190	0.023	*
n_Older_SiblingsNA	0.206	1.229	0.137	2.260	0.130	
HISCLASS						
Hisclass_5Farmers		1 (ref)				
Hisclass_5Elite	-0.308	0.735	0.419	0.540	0.460	
Hisclass_5Lower Middle Class	-0.704	0.495	0.250	7.950	0.005	**
Hisclass_5Self-employed, Skilled	0.278	1.320	0.134	4.270	0.039	*
Hisclass_5Low/ Unskilled	0.102	1.107	0.119	0.740	0.390	
Hisclass_5NA	-0.433	0.649	0.124	12.120	0.001	**
frailty(id)				0.060	0.550	
Interactions						
First_Born_Male:Price_Cycle_Wheat	0.595	1.813	0.559	1.130	0.290	
Gen:Price_Cycle_Wheat	-0.035	0.965	0.420	0.010	0.930	
Fath_Dead1:Price_Cycle_Wheat	-0.444	0.642	0.553	0.640	0.420	
Fath_DeadNA:Price_Cycle_Wheat	-1.531	0.216	0.635	5.820	0.016	*
Moth_Dead1:Price_Cycle_Wheat	0.248	1.282	0.587	0.180	0.670	
Moth_DeadNA:Price_Cycle_Wheat	1.370	3.934	0.627	4.770	0.029	*
Savings_Bank_in_Use:Price_Cycle_Wheat	0.631	1.880	0.393	2.580	0.110	
Price_Cycle_Wheat:n_Older_Siblings[1]	0.389	1.476	0.615	0.400	0.530	
Price_Cycle_Wheat:n_Older_Siblings[2]	-0.552	0.576	0.819	0.450	0.500	
Price_Cycle_Wheat:n_Older_Siblings[3+]	-0.721	0.486	1.031	0.490	0.480	
Price_Cycle_Wheat:n_Older_SiblingsNA	0.139	1.149	0.867	0.030	0.870	
Price_Cycle_Wheat:HisclassElite	2.283	9.811	2.343	0.950	0.330	
Price_Cycle_Wheat:HisclassLower Middle Class	-2.057	0.128	1.603	1.650	0.097	.
Price_Cycle_Wheat:Hisclass_5Self-employed,Skilled	-1.791	0.167	0.868	4.250	0.039	*
Price_Cycle_Wheat:Hisclass_5Low/Unskilled	-0.798	0.450	0.768	1.080	0.300	
Price_Cycle_Wheat:Hisclass_5NA	-1.066	0.344	0.807	1.740	0.190	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 27 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -7748.8
Degrees of freedom for terms= 1.0 1.0 1.0 2.0 2.0 1.0 4.0 5.0 0.1 1.0 1.0 2.0 2.0 1.0 4.0 5.0
Concordance= 0.594 (se = 0.009)
Likelihood ratio test= 150.9 on 33.06 df, p=<2e-16

Results Table 10: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Model with Interactions, Meerssen 1870 – 1899

Number of events = 1206

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		1.628	5.093	1.589	1.050	0.310	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.040	1.041	0.082	0.230	0.630	
Gen							
	MALE		1 (ref)				
	FEMALE	0.195	1.215	0.065	9.020	0.003	**
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	-0.145	0.865	0.085	2.950	0.086	.
	NA	0.228	1.256	0.088	6.630	0.010	*
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	-0.074	0.929	0.100	0.540	0.460	
	NA	0.024	1.024	0.087	0.080	0.780	
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		-0.168	0.845	0.094	3.210	0.073	.
n_Older_Siblings[2]		-0.414	0.661	0.124	11.240	0.001	***
n_Older_Siblings[3+]		-0.134	0.875	0.144	0.860	0.350	
n_Older_SiblingsNA		0.196	1.217	0.107	3.340	0.068	.
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-0.187	0.829	0.265	0.500	0.480	
Hisclass_5Lower Middle Class		-0.074	0.929	0.209	0.120	0.730	
Hisclass_5Self-employed,Skilled		-0.037	0.964	0.179	0.040	0.840	
Hisclass_5Low/Unskilled		0.295	1.343	0.169	3.030	0.082	.
Hisclass_5NA		-0.568	0.567	0.174	10.630	0.001	**

frailty(id)					1.870	0.360	
Interactions							
First_Born_Males:Price_Cycle_Wheat		-0.088	0.916	0.777	0.010	0.910	
Gen:Price_Cycle_Wheat		0.364	1.439	0.609	0.360	0.550	
Fath_Dead1:Price_Cycle_Wheat		0.616	1.852	0.781	0.620	0.430	
Fath_DeadNA:Price_Cycle_Wheat		0.514	1.672	0.822	0.390	0.530	
Moth_Dead1:Price_Cycle_Wheat		0.308	1.361	0.891	0.120	0.730	
Moth_DeadNA:Price_Cycle_Wheat		0.118	1.125	0.806	0.020	0.880	
n_Older_Siblings[1]:Price_Cycle_Wheat		0.194	1.214	0.865	0.050	0.820	
n_Older_Siblings[2]:Price_Cycle_Wheat		-0.885	0.413	1.157	0.580	0.440	
n_Older_Siblings[3+]:Price_Cycle_Wheat		3.009	20.258	1.277	5.550	0.018	*
n_Older_SiblingsNA:Price_Cycle_Wheat		0.318	1.374	1.012	0.100	0.750	
Hisclass_5Elite:Price_Cycle_Wheat		-4.415	0.012	2.456	3.230	0.072	.
Hisclass_5Lower Middle Class:Price_Cycle_Wheat		-0.015	0.985	1.904	0.000	0.990	
Hisclass_5Self-employed,Skilled:Price_Cycle_Wheat		-1.959	0.141	1.650	1.410	0.240	
Hisclass_5Low/Unskilled:Price_Cycle_Wheat		-3.070	0.046	1.551	3.920	0.048	*
Hisclass_5NA:Price_Cycle_Wheat		-2.258	0.105	1.597	2.000	0.160	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 26 Newton-Raphson
Variance of random effect= 0.001545201 I-likelihood = -8047.9
Degrees of freedom for terms= 1.0 1.0 1.0 2.0 2.0 4.0 5.0 1.8 1.0 1.0 2.0 2.0 4.0 5.0
Concordance= 0.637 (se = 0.009)
Likelihood ratio test= 274.7 on 32.82 df, p=0

The main difference of the model that summarises the first two periods of the century is the Price_Cycle_Wheat variable. Also here several trials with alternatives were attempted, again with both promising other price available indicators from the region as well as shifted time lags from 0 to 2 years in steps of four months. Instead of the t-1 years lagged prices, it is the t-1.66 years lagged prices for wheat that reveal the most visible and statistically significant results in the first period. In comparison, for the last period it is the t-1 prices that are more usually used that revealed interaction effects. Thus, when compared to Würselen, until the last third of the century the Meersseners seem to have needed more time to recover from years of economic stress to build up a sufficient fund for marriage. Only during the last period, 1870-1899, the interaction effects with

wheat prices for t-1 become statistically significant, indicating that the Meersseners caught up with the Würseleners in the last decades of the century, therefore recovering and setting up their marriage funds sooner after a short-term crisis than before.

The first-born males have no measurable advantage to marry when compared to the non-first-born males throughout the entire century, even when dividing the century into smaller periods. These results confirm Bras and Kok´s results for the Kennemerland (Bras and Kok 2016). Interestingly, they are much more similar to the far away Dutch case than to the close-by commune of Würselen, which is right on the other side of the national border between the Netherlands and Germany. At first glance, not enough evidence is provided neither for the niche principle nor for impartible inheritance. One might infer a transfer of the parental property with rather even shares for each child being both law and practice in the commune. Under closer examination, however, as will be discussed when testing hypothesis 4, it might also be the case that the last-born son takes over the farm rather than the first-born son, as often happens in both stem and incomplete stem families (Todd 1996[1990], pp. 64-67). In these cases, estates would remain undivided.

Akin to Würselen, Meerssen women marry earlier than men during normal years. The strength of these effects is less pronounced in the first two summarised periods for Meerssen but approaches those for Würselen over the course of the century. The little difference in the share of men and women found in the descriptive statistics part therefore does not lead to considerable advantages for either side. The fact that women do not marry earlier than men in years of economic stress indicates again that women wait out economically stressful years longer than men.

The effects of parental deaths during better years are very similar to the full model in the first two summarised periods. The father's death seems to have little if any effect on the young couple. Additionally, as with the full model, it is impossible to determine the NA cases, which are in turn statistically significant for a majority of alive or dead fathers. But an important shift occurs in the third period, 1870 - 1899, when it becomes harder to marry for ego if the father had died. It may have been the case that the father could have taken over a supportive role in this last period, indicating no more patriarchal constraints to marry but voluntary (financial) help from his side. When he dies, marriage is delayed during better years and promoted during times of economic stress. In the latter case, the need grows stronger to marry more quickly for the eldest, in order to substitute for him in these late years of the century, when female participation in the labour market decreases and the importance of the male breadwinner increases (see again chapter 4.2.4). This

suggests an apparent need to pool resources and to substitute male income. Younger siblings are also incited to marry quicker in order to reduce household size and consumption (cf. Voland and Willführ 2017, p. 10). Other than for Würselen, the effects of the death of the mother are almost entirely absent. With Limburg providing a large supportive network for both the needy and the elderly, it is very likely that there are possibilities to use the respective supportive institutions from early on in the century. In this case, a living mother would not put too large a strain on the couple as support could be outsourced.

Older siblings, instead, almost always impede marriages for their younger siblings in Meerssen both during normal years and under economic stress, confirming the results for the full model. Only during the last period does the presence of many older siblings seem to facilitate marriage under economic pressure. However, the very large effects point to the presence of outliers and therefore should not be taken very meaningfully. Without taking this latter effect into consideration, other than for Würselen, the situation in Meerssen points towards somewhat less supportive or even competing siblings. This again suggests looser family ties, which decrease during the course of the century, perhaps revealing a diminishing cultural norm. Indeed, in the last third of the century the presence of three or more siblings no longer shows a statistically significant negative impact on marriage for the ego. The negative effects of having one older sibling also decreases. A strong and significant effect is evident with the presence of only two older siblings, thus in the middle parity, possibly pointing to a more liberal family policy towards the youngest children and more choice.

Concerning the Hisclass_5 variable, as indicated above, it is the lower strata that generally marries earlier than the farmers in good years. This implies that farmers must wait until their niche becomes free. These effects are stable during the first two summarised periods of the century and remain true for the unskilled workers in the last period only, also in terms of statistical significance. Evidence for vulnerability to economic stress is found in both the two summarised periods and in the last period of the century. Whereas it is the large majority of the commune that is affected from 1810-1869, visible through the general strong negative effect of economic stress, it is only the lower strata that clearly reacts to economic pressure in the last period by delaying marriage. On the one hand, as with Würselen, this suggests that inspite of the continuous development of institutions that attenuate economic stress and the loosening family ties, the Meersseners were unable to achieve full resilience to economic stress by the end of the 19th century. On the other

hand, the situation is clearly ameliorating here: the lower middle class, who originally in the first two summarised periods displayed signs of vulnerability to economic stress through considerable effects and a p-value, now manages to marry fully independent from economic stress.

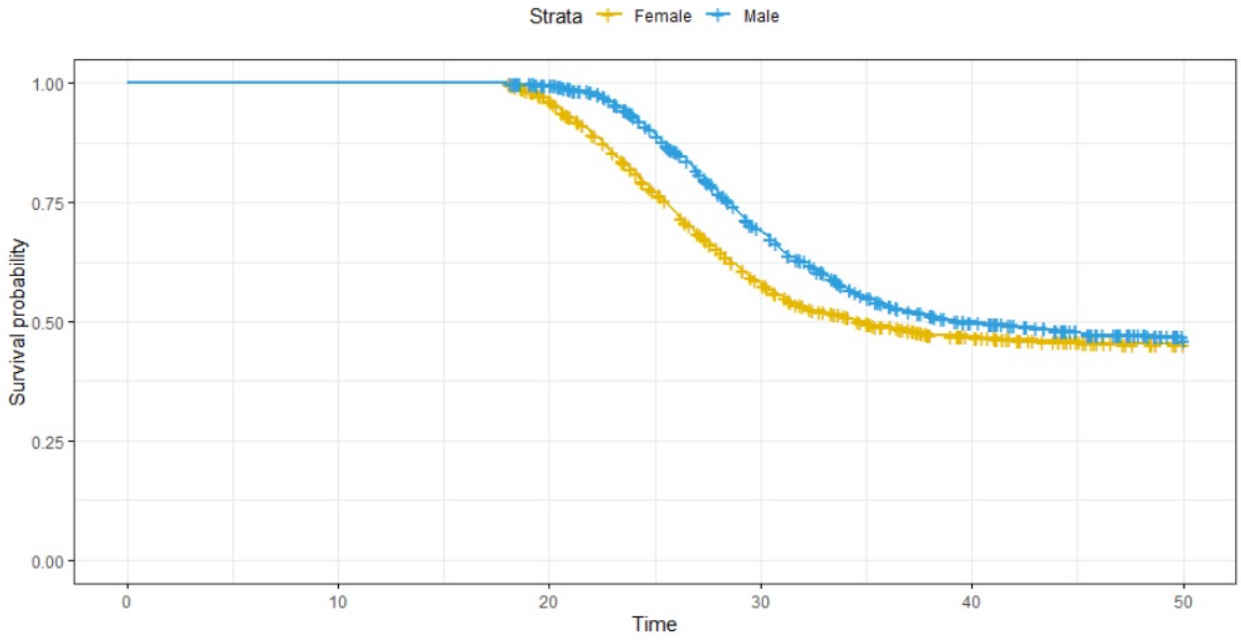
The Small_credits_in_use variable, in turn, had to be left out of the statistical model. Its year of significant impact, namely 1874, cannot be used to further divide the last period. It can only be analysed contextually, therefore will be the topic of further discussion.

5.3 Sart

5.3.1 Descriptive Statistics Sart

Finally, the descriptive statistics section for Sart will also begin with a probability distribution for not marrying.

Figure 22: Probabilities of Not Marrying in Sart 1810 – 1899



Source: EAP Sart Data, own calculations and illustration

Figure 22 shows two main differences when compared to those for Würselen and Meerssen: first, the share of around 45% of individuals never experiencing an event is even higher than documented for the other two cases. Indeed about 50% of the Sartians who experience a marriage event do not have a date assigned to it. The results when combined with the Knodel and Maynes method, however, seem to be somewhat realistic.

Table 37: Deceased and Never Married in Sart 1800-1899

	1800 - 1899					
	M	Share	F	Share	Total	Share
Deceased Sart	2175		2037		4212	
Deceased 45 - 49 years	62	100.0%	73	100.0%	135	100.0%
Deceased 45 - 49 years not married	15	24.2%	6	8.2%	21	15.6%

Source: Famileinbuch Euregio

According to this table about 15.6% of the Sartians never marry.

Second, the risk of not marrying also appears to decrease at a slower rate over time. The technical construction of the figure is equal to the former two. Therefore, regarding the first observation, the proportion of non-married people in Sart from 1810-1899 can only be explained by unfavourable data. Particularly the early decades of the century are characterised occasionally by a large amount of missing marriage dates. The share of those who never married, therefore, is estimated too high here.

When following Alter, Oris, and Neven, the share of those who are not married in the population is around 40% or higher, with a decreasing tendency towards the end of the century (Alter et al. 2007, p. 146). Overall, with the figures for men being slightly higher,[58] "only 12 percent of 45-49 -year-old women had never been married in Sart […]" (ibid.), more individuals remain unmarried than in the other two communes. Furthermore, for Sart, there is no information on the actual marriage location. It was therefore decided to use the birth location when filtering the data and to assume that those who are born in Sart and have no confirmed migration event before marriage either married in Sart or have not married at all. This also led to a reduced number of analysable observations, resulting in 1109 events that remained in the sample. To comment on the second observation, another difference to Würselen and Meerssen is that the risk of not marrying for Sart seems to decrease somewhat slower over the individuals´ lifetime. The negative slope of the curve becomes less pronounced only from about 32 years or later, pointing towards higher ages at first

[58] Logically inferred from the ratio of 134 men to 100 women of age 20-35 in Sart in the sample of the EAP researchers' sample (Oris et al. 2014, p. 280).

marriage. When now again comparing mean ages at marriage, further support is found in Table 38[59]:

Table 38: Mean Age of First Marriage and Age Differences of Partners in Sart 1810 – 1899

	Mean Age of first Marriage			
Period	**Total**	**Men**	**Women**	**Age Difference**
1810	26.7	28.2	25.3	2.9
1820	26.8	27.2	26.4	0.8
1830	27.7	28.9	26.4	2.6
1840	27.2	28.9	25.5	3.4
1850	29.0	31.8	26.2	5.6
1860	27.1	28.2	26.0	2.2
1870	27.9	29.1	26.6	2.4
1880	29.4	31.2	27.5	3.7
1890	29.0	30.8	27.3	3.5
Mean	27.9	29.4	26.4	3.0

Source: EAP Sart Data, own calculations

The mean ages of marriages for Sart are somewhere in between of those for Würselen and Meerssen during the first half of the century. The main differences are found in the second half, when the Sartians marry about 1.5 to 2 years later than their peers in the other two locations. While the mean age at first marriage decreases for both Würselen and especially Meerssen towards the end of the century, it fluctuates back and forth for men in Sart, though with an increasing trend.

[59] The results are similar to those of the EAP. The slightly diverging mean ages at first marriage result from differences in the categorisation of the periods. Due to these differences, the results slightly diverge from the trends of former research while the overall means remain almost identical e.g., compare Neven 2002, p. 43; Alter et al. 2010, p. 201.

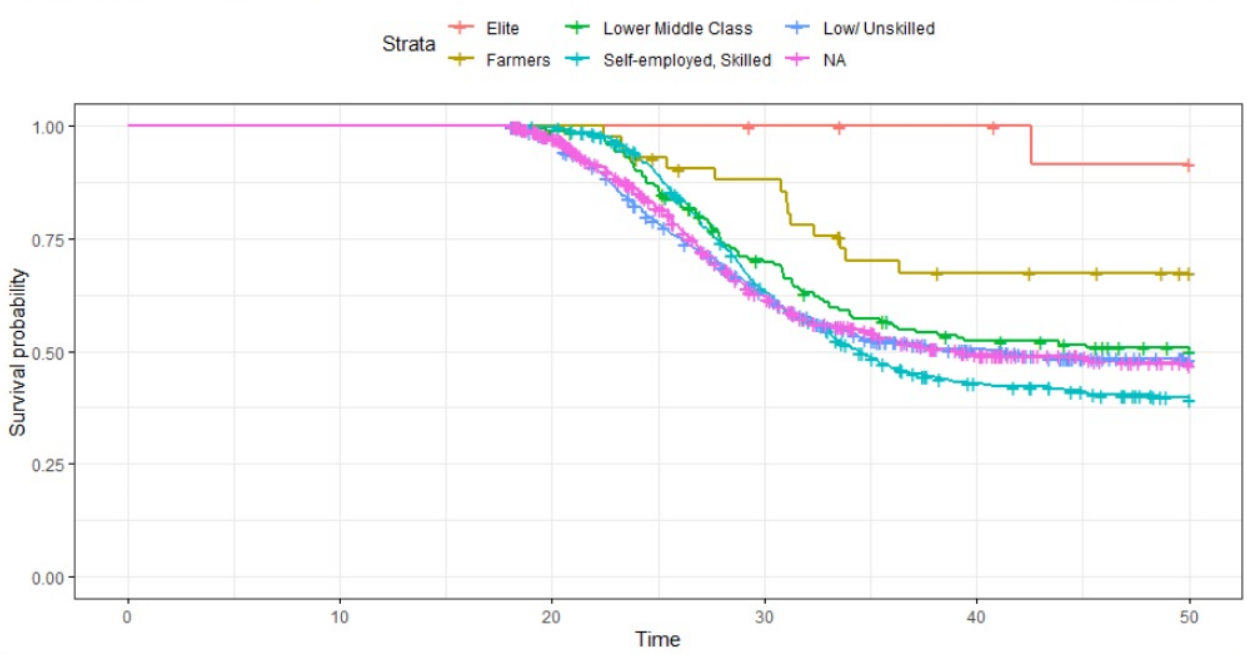
For women it constantly increases during the later decades. The Sartians thus face higher constraints to marry the longer the century lasts – a development that is opposite to that of Meerssen.[60]

The most striking difference, however, are the age differences between the partners. While in the first three decades these are rather similar to the other two communes, they increase significantly during the 1840s and 1850s and also remain high in the last two decades under research. This is mainly due to the increase in the mean marriage age of men, which is likely related to the constraints men had to face when setting up a marriage fund. This was especially the case during the early years of industrial take-off, when industrialisation had begun to affect Sart but to a such small extent that the majority of local society did not profit from it. These higher age differences between the partners usually point to a somewhat stronger male authority among couples and higher patriarchy levels in general (see for instance Gruber and Szoltysek 2012, p. 4) when compared to the other two communes. It may also point to increasing patriarchy levels owed to the strong decline of women´s participation in the labour market among all three communes and the strengthening of the male breadwinner system as described under 4.2.4. The modelling results shall provide further insights. The more pronounced patriarchy of Sart is further supported by the proportion of young brides, 0.06, that is considerably higher than for Würselen and Meerssen and by the proportion of older wives, 0.22, which is, in turn, considerably lower.

The following graph again shows the differences in marriage behaviour for the social classes in Sart.

[60] Again, consistent to the EAP where it could be shown that real wages decrease in the last third of the century (Alter et al. 2004c, p. 194).

Figure 23: Probabilities of Not Marrying in Sart 1810 – 1899 by Social Classes



Source: EAP Sart Data, own calculations and illustration

The figure clearly shows that there are hardly any cases for the elite. Therefore, no statement can be regarded as sufficiently proven here. In comparison, the farmers appear to follow the more average curves of the other classes that produce Figure 23. The best chances for marriage are for those who are in the self-employed, skilled group. The rather low chances for the lower middle class could be explained by a marriage market where it is simply easier to find a partner in larger groups, given that they do not marry across the social classes. The group of the lower middle class and therefore the potential of suitable marriage partners is small, resulting in longer waiting times. In any case, as in the other two communes, a clear Western European marriage pattern is observable (Neven 2002, p. 42). In Sart, however, the possibilities for couples to marry are considerably more determined by external constraints when compared to those of Würselen and Meerssen. Let us take a look at the descriptive statistics of the variables for the models for Sart:

Table 39: Means and Frequencies of the Variables Used in the Modelling of First Marriages in Sart 1810 – 1899

Price_Cycle_Wheat (t-1)	Mean	Standard Deviation					
	0	0.14					
Cycle_Hypotheque (t-1)	Mean	Standard Deviation					
	0	0.08					
First_Born_Male	No	Yes					Sum
Number	1581	263					1844
%	85.6	14.3					100
Gen	Male	Female					Sum
Number	941	903					1844
%	51.0	49.0					100
Fath_Dead	No	Yes	NA				Sum*
Number	1055	723	525				2303
%	45.8	31.4	22.8				100
Moth_Dead	No	Yes	NA				Sum*
Number	1053	621	593				2267
%	46.4	27.4	26.2				100
n_Older_Siblings	0	1	2	3	NA		Sum*
Number	1101	293	134	60	359		1947
%	56.5	15.0	6.9	3.1	18.4		100
Hisclass_5	Elite	Lower Middle Class	Self-employed, Skilled	Farmers	Low/ Unskilled	NA	Sum
Number	5	16	95	632	616	480	1844
%	0.3	0.9	5.2	34.3	33.4	26.0	100

*Double-countings from time-variation resulting in changing spells. Changing spells added to n=1844
Source: EAP Price Data, author's own material, EAP Sart Data, own calculations

To start again with the description of local wheat prices as the main indicator for economic stress, these prices were initially lagged for 1 year. However, as with the EAP project, and with the one very small exception of a positive effect of the Fath_Dead variable, no interaction effects could be found with demographic responses (Oris et al. 2014, pp. 278f, 282-285). The self-gathered

potential proxies for economic stress couldn´t reveal any interaction effects either: neither the communal accounts, nor the number of short-term prisoners, nor the yearly change of the mortgage rates revealed any statistically significant results. Among these additional proxies, the latter still proved to be most promising during the various tests. It is therefore included in the models. In order to stick to the modelling philosophy of the most parsimonious model initiated in chapter III, it was decided to leave out the other remaining proxies. Additionally, the 1109 events could not be meaningfully divided into three periods. As with Meerssen, the first two periods for Sart also had to be summarised into one in order to ensure an analysis of sufficient cases for obtaining analysable results. These constructed periods, however, were additionally adapted to Verviers´ earlier-occurring economic growth phase 1810-1859 for the first period and its maturation phase 1860-1899, as elaborated under 4.1. Despite these shortcomings, however, the data does not lag behind in information density and quality when compared to the other two samples.

The share of identified first-born males in Sart is slightly higher than for Würselen and Meerssen. It seems reasonable to assume that a larger emigration resulted in a higher share of firstborn males living in Sart. First-born males constitute 14.3% of the sample, slightly higher than in Würselen and Meerssen, pointing to a higher share of first-born sons remaining in Sart while later-born children would migrate more often than the other two communes. 4.8% of the male parities are not assignable.

The share of men and women is comparable to both other communes and almost equals that of Meerssen. It is reasonable to assume that this small difference will hardly affect the results.

The share of NA cases for deceased parents is lower for Sart than for the other two cases and especially lower than in Meerssen. Accordingly, the share of dead parents before marriage increases. Hence, the information given here promises significant results for both the Fath_Dead and the Moth_Dead variables. The comparison is somewhat biased however as Sart has no information on marriage location and therefore only individuals who were born here were taken into the sample.

The n_Older_Siblings variable, however, shows lower figures for individuals without any older siblings for Sart, especially when compared to Würselen. The NA cases are not higher than in Würselen but the large share of individuals without any siblings probably points towards a weaker family reconstitution success when compared to the genealogical data of Würselen and Meerssen

(remember that Meerssen has a comparable share of individuals with no siblings but a much lower share of NA cases).

The largest difference in information density is given by the Hisclass_5 variables. A considerably higher share of information on occupation could be assigned to the respective individuals in the sample for Sart. Only one quarter remains without information here, whereas it was 56.8% for Würselen and 44.5% for Meerssen. Let us now turn to the calculation results:

5.3.2 Results Sart

Results Table 11: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Full Model without Interactions, Sart 1810 – 1899

Individuals 1844, number of events = 1109

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		-0.206	0.814	0.222	0.860	0.350	
Cycle_Hypotheque		0.185	1.204	0.378	0.240	0.620	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.325	1.384	0.088	13.720	0.000	***
Gen							
	MALE		1 (ref)				
	FEMALE	0.311	1.365	0.083	14.150	0.000	***
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.265	1.303	0.070	14.480	0.000	***
	NA	-0.298	0.742	0.093	10.170	0.001	**
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.191	1.210	0.073	6.940	0.008	**
	NA	-0.225	0.798	0.086	6.890	0.009	**
Savings_Bank_in_Use							
	FALSE		1 (ref)				
	TRUE	0.751	2.120	0.072	108.900	0.000	***
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		0.085	1.089	0.106	0.650	0.420	

n_Older_Siblings[2]		0.262	1.299	0.142	3.420	0.064	.
n_Older_Siblings[3]		0.092	1.096	0.186	0.240	0.620	
n_Older_SiblingsNA		0.438	1.550	0.091	23.450	0.000	***
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-15.623	0.000	1470.000	0.000	0.990	
Hisclass_5Lower Middle Class		-0.450	0.637	0.412	1.190	0.270	
Hisclass_5Self-employed, Skilled		-0.060	0.942	0.140	0.180	0.670	
Hisclass_5Low/ Unskilled		-0.126	0.881	0.091	1.930	0.160	
Hisclass_5NA		-0.233	0.792	0.102	5.230	0.022	*
frailty(id)					0.000	0.860	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 6 outer, 38 Newton-Raphson
Variance of random effect= 5e-07 I-likelihood = -7496.9
Degrees of freedom for terms= 1 1 1 1 2 2 1 4 5 0
Concordance= 0.628 (se = 0.009)
Likelihood ratio test= 296.5 on 18 df, p=0

As already indicated above, the number of individuals and events for the models for Sart has again halved when compared to Meerssen. However, with a somewhat higher information density of the Sart data and ten statistically significant variables found in the full model without interactions, the results can be considered to be as meaningful as those for Meerssen which produced the same amount of statistically significant effects. The overall p-value, in consequence, shows a model as robust as the one for Meerssen.

The full model without interaction effects for Sart shows some negative effects of one-year lagged wheat prices for the likelihood of marriage. So far, however, the effects remain without statistical significance. The second indicator for economic stress, the Cycle_Hypotheque variable has a too high p-value to make any further assumptions.

The First_Born_Male variable, instead, clearly depicts a positive effect on marriage, an effect which differs to that of Meerssen but is very similar to that of Würselen. As inheritance practices should be expected to be more in line with the French law in Sart (see again 4.2.5), however, the explanation must be a different one than the advantages given by impartible inheritance for the first-born males in Würselen. It is more likely that the first-born males in Sart generally profit from a higher social standing. Though not obtaining the full estates with inheritance as their counter

parts in Würselen, the birth rank alone could give the first-borns some advantages in terms of social significance and resource allocation for instance, as was typical for a first-born son in many (more) patriarchally organised societies.

As already seen above for both Würselen and Meerssen, in Sart women also marry earlier than men. Again, the small difference of men and women in the sample has no effect on the likelihood of marriage.

The variables of the death of parents have the greatest impact on the marriage, confirming the conclusion by Oris et al. of the positive effect of the parents' death on marriage, who suggest that "some couples who had been discouraged from marrying by their parents were free to marry after a parent died" (Oris et. al. 2014, p. 277ff.). Both statistical significance and size (sometimes even higher for Sart for both variables), are very similar to Würselen, while differing considerably from Meerssen. Both the death of the father as well as the death of the mother allow individuals to marry earlier throughout the century, also confirming the findings of Bras and Kok as well as those for Voland and Willführ (Bras and Kok 2016 p. 199; Voland and Willführ 2017, pp. 128, 133f). The figures therefore infer children´s caretaking obligations towards their elderly parents, as caretaking institutions are especially underdeveloped in Sart when compared to the other two communes (see again chapter 4.2.3), clearly reducing options for its outsourcing.

The presence of older siblings also has an impact on the marriage behaviour of the Sartians. It seems favourable to have 2 older siblings in Sart instead of having 1 as for Würselen, indicating a poorer commune where an additional older sibling is needed to support the marriage fund, most probably through informal lending as shown under 4.2.5. The cultural norm of the youngest sons and daughters expected to assist the parents in old age is not supported here.

The Hisclass_5 group behaves very different to the former two villages. As found by the EAP researchers (Oris et al. 2014, pp. 278f), especially the poorest and the middle strata delay marriage when compared to the farmers, pointing towards a much more restricted society when it comes to marriage possibilities in general. These effects, however, are not statistically significant so far and an interpretation must be postponed until the splitting of the models.

The large effect of the Savings_Bank_in_use variable points towards more marriages and a more complete picture of marriages and marriage dates during the last third of the century. The appearance of formal small-credit-lending institutions at the very last decade of the century, as was

elaborated under 4.2.2, however, arrives too late to have any visible impact in Sart and is thus intentionally left out.

The NA cases are especially significant here. For the death of the parents, it seems that the NA cases contain a lot of still-living parents when their children marry which explains the complementary effect of their death before the marriage of their children. The NA n_Older_Siblings variable suggests that many Sartians lost siblings due to emigration, resulting in an increased likelihood to marry. The NA Hisclass_5 group follows Würselen and Meerssen to some extent. Seen that we find an almost equal share of women here, this group probably contains more lower-class individuals compared to the other villages.

Before proceeding with the two separated models, let us now turn to the full model complemented by interactions.

Results Table 12: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Full Model with Interactions, Sart 1810 – 1899

Individuals 1844, number of events = 1109

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		0.367	1.443	0.710	0.270	0.610	
Cycle_Hypotheque		0.227	1.255	0.383	0.350	0.550	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.323	1.382	0.088	13.520	0.000	***
Gen							
	MALE		1 (ref)				
	FEMALE	0.313	1.367	0.083	14.280	0.000	***
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.265	1.303	0.070	14.450	0.000	***
	NA	-0.303	0.739	0.094	10.420	0.001	**
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.187	1.206	0.073	6.640	0.010	*
	NA	-0.225	0.799	0.086	6.850	0.009	**
Savings_Bank_in_Use							
	FALSE		1 (ref)				
	TRUE	0.750	2.116	0.072	107.960	0.000	***
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		0.083	1.087	0.106	0.610	0.430	
n_Older_Siblings[2]		0.261	1.299	0.142	3.410	0.065	.
n_Older_Siblings[3]		0.088	1.091	0.186	0.220	0.640	
n_Older_SiblingsNA		0.438	1.549	0.091	23.380	0.000	***
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-15.627	0.000	1475.000	0.000	0.990	
Hisclass_5Lower Middle Class		-0.455	0.634	0.415	1.200	0.270	
Hisclass_5Self-employed, Skilled		-0.061	0.941	0.140	0.190	0.660	
Hisclass_5Low/ Unskilled		-0.129	0.879	0.091	2.020	0.160	
Hisclass_5NA		-0.236	0.790	0.102	5.330	0.021	*
frailty(id)					0.000	0.860	

Interactions						
First_Born_Male:Price_Cycle_Wheat	-0.115	0.891	0.618	0.030	0.850	
Gen:Price_Cycle_Wheat	0.289	1.335	0.653	0.200	0.660	
Fath_Dead1:Price_Cycle_Wheat	0.315	1.371	0.521	0.370	0.550	
Fath_DeadNA:Price_Cycle_Wheat	-0.660	0.517	0.671	0.970	0.330	
Moth_Dead1:Price_Cycle_Wheat	-0.745	0.475	0.555	1.800	0.180	
Moth_DeadNA:Price_Cycle_Wheat	0.260	1.297	0.643	0.160	0.690	
Savings_Bank_in_Use:Price_Cycle_Wheat	-1.103	0.332	0.746	2.190	0.140	
Price_Cycle_Wheat:n_Older_Siblings[1]	-0.516	0.597	0.796	0.420	0.520	
Price_Cycle_Wheat:n_Older_Siblings[2]	-0.558	0.572	1.029	0.290	0.590	
Price_Cycle_Wheat:n_Older_Siblings[3]	-0.480	0.619	1.331	0.130	0.720	
Price_Cycle_Wheat:n_Older_SiblingsNA	-0.297	0.743	0.782	0.140	0.700	
Price_Cycle_Wheat:HisclassElite	0.144	1.154	7637.000	0.000	1.000	
Price_Cycle_Wheat:HisclassLower Middle Class	-0.847	0.429	3.016	0.080	0.780	
Price_Cycle_Wheat:Hisclass_5Self-employed,Skilled	-0.071	0.932	1.070	0.000	0.950	
Price_Cycle_Wheat:Hisclass_5Low/Unskilled	-0.541	0.582	0.715	0.570	0.450	
Price_Cycle_Wheat:Hisclass_5NA	-0.015	0.986	0.803	0.000	0.990	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 6 outer, 38 Newton-Raphson
Variance of random effect= 5e-07 I-likelihood = -7493.1
Degrees of freedom for terms= 1 1 1 1 2 2 1 4 5 0 1 1 2 2 1 4 5
Concordance= 0.63 (se = 0.009)
Likelihood ratio test= 304.1 on 34 df, p=0

As seen for Würselen and Meerssen, the Price_Cycle_Wheat variable is the only variable that sustainably changes its values when compared to the full model without interactions. The resulting very high p-value offers no clear interpretation.

Concerning the interaction effects, the results are rather disappointing. The negative effect of the death of the mother during years of economic pressure results in a large effect and a p-value that is almost statistically significant, marking this variable as the only one that could give a hint to future significant results when further examining the model. As the only noteworthy interaction

effect, however, it is hard to create a convincing overall picture through these findings. It is therefore best to now move on to examining and dividing the full model further.

Results Table 13: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Model with Interactions, Sart 1810 – 1859

Number of events = 582

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		0.394	1.483	0.821	0.230	0.630	
Cycle_Hypotheque		-0.246	0.782	0.426	0.330	0.560	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.362	1.437	0.123	8.660	0.003	**
Gen							
	MALE		1 (ref)				
	FEMALE	0.468	1.597	0.133	12.400	0.000	***
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.298	1.348	0.095	9.850	0.002	**
	NA	-0.623	0.537	0.149	17.460	0.000	***
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.327	1.386	0.097	11.290	0.001	**
	NA	-0.239	0.787	0.140	2.930	0.087	.
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		0.119	1.126	0.141	0.710	0.400	
n_Older_Siblings[2]		0.363	1.437	0.167	4.750	0.029	*
n_Older_Siblings[3]		0.219	1.244	0.205	1.130	0.290	
n_Older_SiblingsNA		0.495	1.640	0.162	9.370	0.002	**
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-16.758	0.000	2749.000	0.000	1.000	
Hisclass_5Lower Middle Class		-1.036	0.355	0.767	1.830	0.180	
Hisclass_5Self-employed, Skilled		-0.268	0.765	0.218	1.510	0.220	
Hisclass_5Low/ Unskilled		-0.331	0.718	0.141	5.510	0.019	*
Hisclass_5NA		-0.597	0.551	0.171	12.170	0.000	***
frailty(id)					0.000	0.860	
Interactions							
First_Born_Male:Price_Cycle_Wheat		-0.250	0.779	0.722	0.120	0.730	

Gen:Price_Cycle_Wheat	0.128	1.136	0.826	0.020	0.880	
Fath_Dead1:Price_Cycle_Wheat	0.673	1.960	0.588	1.310	0.250	
Fath_DeadNA:Price_Cycle_Wheat	-1.186	0.305	0.843	1.980	0.160	
Moth_Dead1:Price_Cycle_Wheat	-0.444	0.642	0.624	0.510	0.480	
Moth_DeadNA:Price_Cycle_Wheat	0.510	1.666	0.791	0.420	0.520	
Price_Cycle_Wheat:n_Older_Siblings[1]	-0.842	0.431	0.900	0.880	0.350	
Price_Cycle_Wheat:n_Older_Siblings[2]	-0.877	0.416	1.085	0.650	0.420	
Price_Cycle_Wheat:n_Older_Siblings[3]	-0.593	0.553	1.361	0.190	0.660	
Price_Cycle_Wheat:n_Older_SiblingsNA	-1.092	0.335	1.058	1.070	0.300	
Price_Cycle_Wheat:HisclassElite	0.426	1.531	13920.000	0.000	1.000	
Price_Cycle_Wheat:HisclassLower Middle Class	-5.593	0.004	4.999	1.250	0.260	
Price_Cycle_Wheat:Hisclass_5Self-employed,Skilled	1.003	2.725	1.233	0.660	0.420	
Price_Cycle_Wheat:Hisclass_5Low/Unskilled	-0.205	0.815	0.890	0.050	0.820	
Price_Cycle_Wheat:Hisclass_5NA	0.477	1.611	1.029	0.210	0.640	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 6 outer, 38 Newton-Raphson
Variance of random effect= 5e-07 I-likelihood = -7494.6
Degrees of freedom for terms= 1 1 1 1 2 2 1 4 5 0 1 1 2 2 1 4 5
Concordance= 0.633 (se = 0.009)
Likelihood ratio test= 326.3 on 34 df, p=0

Results Table 14: Cox Regression Estimates (Relative Risks of Marrying): Unmarried 16 (f), 18 (m) to 50 Years, Model with Interactions, Sart 1860 – 1899

Number of events = 527

		coef	exp(coef)	se(coef)	Chisq	Pr(>|z|)	
Price_Cycle_Wheat		-0.154	0.857	1.301	0.010	0.910	
Cycle_Hypotheque		1.128	3.090	0.937	1.450	0.230	
First_Born_Male							
	FALSE		1 (ref)				
	TRUE	0.151	1.163	0.129	1.370	0.240	
Gen							
	MALE		1 (ref)				

	FEMALE	0.206	1.228	0.114	3.250	0.071	.
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0.235	1.264	0.103	5.180	0.023	*
	NA	0.134	1.144	0.124	1.180	0.280	
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	0.084	1.088	0.110	0.580	0.440	
	NA	-0.062	0.940	0.112	0.310	0.580	
Older_Siblings							
n_Older_Siblings[0]			1 (ref)				
n_Older_Siblings[1]		-0.232	0.793	0.181	1.640	0.200	
n_Older_Siblings[2]		-0.755	0.470	0.468	2.610	0.110	
n_Older_Siblings[3]		-16.942	0.000	3233.000	0.000	1.000	
n_Older_SiblingsNA		0.362	1.436	0.108	11.210	0.001	***
HISCLASS							
Hisclass_5Farmers			1 (ref)				
Hisclass_5Elite		-15.627	0.000	1475.000	0.000	0.990	
Hisclass_5Lower Middle Class		-0.455	0.634	0.415	1.200	0.270	
Hisclass_5Self-employed, Skilled		-0.061	0.941	0.140	0.190	0.660	
Hisclass_5Low/ Unskilled		-0.129	0.879	0.091	2.020	0.160	
Hisclass_5NA		-0.236	0.790	0.102	5.330	0.021	*
frailty(id)					0.000	0.890	
Interactions							
First_Born_Male:Price_Cycle_Wheat		2.196	8.987	1.273	2.970	0.085	.
Gen:Price_Cycle_Wheat		0.460	1.584	1.171	0.150	0.690	
Fath_Dead1:Price_Cycle_Wheat		-0.246	0.782	1.027	0.060	0.810	
Fath_DeadNA:Price_Cycle_Wheat		0.606	1.833	1.303	0.220	0.640	
Moth_Dead1:Price_Cycle_Wheat		-1.270	0.281	1.104	1.320	0.250	
Moth_DeadNA:Price_Cycle_Wheat		0.143	1.154	1.163	0.020	0.900	
Price_Cycle_Wheat:n_Older_Siblings[1]		-1.314	0.269	1.747	0.570	0.450	
Price_Cycle_Wheat:n_Older_Siblings[2]		-1.997	0.136	4.188	0.230	0.630	
Price_Cycle_Wheat:n_Older_Siblings[3]		0.696	2.006	26950.000	0.000	1.000	
Price_Cycle_Wheat:n_Older_SiblingsNA		1.563	4.772	1.099	2.020	0.160	
Price_Cycle_Wheat:HisclassElite			NA	0.000			

Price_Cycle_Wheat:HisclassLower Middle Class	5.345	209.600	6.335	0.710	0.400	
Price_Cycle_Wheat:Hisclass_5Self-employed,Skilled	-1.566	0.209	2.058	0.580	0.450	
Price_Cycle_Wheat:Hisclass_5Low/Unskilled	-2.275	0.103	1.329	2.930	0.087	.
Price_Cycle_Wheat:Hisclass_5NA	-1.137	0.321	1.388	0.670	0.410	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 6 outer, 42 Newton-Raphson
Variance of random effect= 5e-07 I-likelihood = -2968.6
Degrees of freedom for terms= 1 1 1 1 2 2 4 4 0 1 1 2 2 4 4
Concordance= 0.585 (se = 0.014)
Likelihood ratio test= 55.2 on 30 df, p=0.003369

When looking at the 2 models in general, the 2nd model appears to be the least stable. The overall p-value does still indicate a high statistical significance (on the 99.99% level) but also a lower one than for the former models. Additionally, due to the rather small number of cases some variables reveal no or very few observations, rendering an interpretation impossible. For example, there is no event for the elite group, only 5 cases for the lower middle class, and only 1 case where an individual has 3 or more older siblings in the later period. These three variables, therefore, must be excluded from further discussion.

As with the EAP researchers and the full model above, the present study was again unable to detect any interaction effects between any of the pre-existing economic indicators and marriage behaviour. Neither the economic-stress-approximating variables nor different trials of time-lagging indicators revealed any effects on marriage. The only exception was the t-0.66 years lagged Price_Cycle_Wheat variable in the second period. Both the skilled and the unskilled workers are affected by economic stress here, the latter with a statistically significant effect. It is these effects, however, that reveal how Sartians were vulnerable to economic stress throughout the entire century. If more local and precise grain price data had been available, statistical significance on delaying marriage could have been obtained most probably.

As with Meerssen, the results for the first two summarised periods are quite similar to the full models. An observable change, though, occurs in the second period: similar to Fertig and Fertig´s results for Westphalia (Fertig and Fertig 2006, p. 185), a first-born male has higher chances of marrying in the first period, but the effect loses its statistical significance during the second period. The first period could be a result of a Sart-specific niche principle in the following sense: the large

share of farmers in the sample points towards a more agrarian-pronounced society where farmland remains an important income for those who could inherit it (see again Bracht 2013, chapter 3.2; cf. Bengtsson 2004a, pp. 48f). The only difference to the niche principle is that in Sart more than one male heir would inherit a piece of land from either elderly parents or after their death. Nevertheless, only one son, probably the first born, would still take over the household and inherit an already-established business after the death of his parents. He would also have the opportunity to maintain more shares of land by paying off his siblings. For the second period, it may be that women also receive their share of the inheritance mass, hence reducing the strengths of these effects for first-born men. The advantage of being a first-born male under years of economic stress in the later period can be explained by the need to pool resources in these difficult years. The first-born and his wife would have to support the now-elderly parents, who would likely move into the household for a while (Todd 1996[1990], pp. 67, 64).

Being female remains an advantage on the marriage market throughout the century and in both periods. The weakened statistical significance of this effect from the 1870s onwards supports the fact that emigration rises throughout the century (Neven 2002, p. 43) and that this emigration is probably pursued primarily by those unable to marry (Oris et al. 2014, p. 276), logically, therefore, mainly men.[61] But also in Sart there are no signs for women marrying earlier than men in years of economic pressure.

The positive effects of parental deaths to marriage confirm the findings by EAP researchers: during normal years, alive parents, especially the father, exert control over their children and have strong hindering effects on their marriage (Oris et al. 2014, pp. 276ff). When viewed in the context of Frost's findings that relatives increasingly interfered in marriage decisions (Frost 1995, p. 90), the strength of the effect of fathers confirms a relatively high degree of patriarchy in Sart. Particularly a father of an incomplete stem family would be able to exercise more power over his children than a father who hands over his property to one child only. He would also be able to veto his children's marriage with 'unsuitable' partners as it was him deciding over the distribution of the inheritance mass. One can further explain the large positive impact of a father´s death on the timing and likelihood of marriage through the rising life expectancy in eastern Belgium (Neven 2002, p. 41),

[61] Remember that their age of marriage rises significantly in the latter period, pointing towards larger difficulties to set up a marriage fund.

the fact that “farmers in Sart did not yield their farms to their sons” through retirement contracts (Alter et al. 2004c, p. 196), and the related increase of marriage age in the last third of the century. As the death of the father as well as the death of the mother facilitate marriage in both periods, the impression of the children taking care of them in old age is further supported. Although caretaking institutions could be found in Verviers, this is not to the same extent as in Meerssen and with a much greater distance than for the Dutch example. The options for outsourcing caretaking in Sart therefore appear to be of a rather rudimentary character. The death of either parent appears to have little impact during years of economic stress, possibly explained by the less favourable price data for Sart. However, the weakening effect of the fathers’ death and lack of effect of the mothers´ death in the last period may be the first signs of loosening family ties in Sart during and because of increasing industrialisation. As with Würselen and Meerssen, however, this does not suffice to wholly distinguish marriage behaviour from economic stress.

Dividing the full model reveals that the presence of a few older siblings only has a positive impact on the marriage behaviour of the Sartians during the first period. Those who have 2 older siblings tend to marry earlier than those without any older siblings. If one older sibling failed to make a proper living, a scene that often occurred in the surroundings of Sart as described under 4.2, either the second sibling or both could pool some resources to help their younger sibling. However, during the last period under research these siblings become an obstacle to marriage for the ego. The presence of either one or two older siblings delays marriage, with effects being close and very close to statistical significance respectively. These results support the findings of Bras and Kok, stating that it is an advantage to marry if an individual is born as a middle child (Bras and Kok 2016, p. 200). As the total fertility rate in 19th century Sart was 4.4 (Oris et al. 2014, p. 267), the presence of two older siblings usually meant being born as a middle child. Hence, resource dilution (Bras et al. 2010; Kok et al. 2011; Öberg 2017) and competition (see again Voland and Willführ 2017, p. 134) are much less present for the ego and his or her older siblings in Sart than in Würselen and especially in Meerssen.

The Hisclass_5 variables are rather difficult to compare with the EAP due to the splitting of EAP models into models for men and women and due to differences in the coding of occupations. However, some general comparison is possible: as with the full model, the first period confirms the results of the EAP in a statistically significant manner even for better economic years. Especially the poorer strata are forced to delay marriages due to a restricted environment in Sart

(Oris et al. 2014, p. 289). Thus, even though the peasants of Sart have considerably smaller farms than their counterparts in Würselen and Meerssen, every additional piece of land brings some more prosperity to the owner when compared to the landless (Dipper 1986, p. 249; Medick 1997, p. 148).

These effects decrease in the last period and loose statistical significance. While EAP researchers argue that the constraints are so strong that economic pressure becomes an additional but not the main factor, this however can only be confirmed for the first period where no statistically significant effects are found for interactions of economic stress and marriage behaviour (Oris et al. 2014, p. 289). Such effects are found for the lower strata in the last period, clearly indicating non-resilience and thus vulnerability to economic stress. However, the EAP´s argument could be further supported by loosening family ties. This is because the familial and partner selection constraints responsible for non-reactions to economic stress could reduce in importance throughout the century, placing more weight on another major constraint, namely exogenous economic stress.

5.4 Discussion

Browsing through the results, it becomes clear that demographic behaviour is strongly shaped by institutions. The many effects and the differences in their strengths show that the institutions elaborated in this thesis have strong impacts on the demographic behaviour of individuals and couples in the three communes under focus. Hence, one of the main goals of this study has been achieved, namely to measure the impact of institutions on individuals´ and couples´ demographic behaviour.

When further discussing the many effects found above, hypothesis I (H 1: […] *when economic conditions worsen, a clear postponing of marriage will become visible.*) is confirmed. The couples clearly react to rising food prices by delaying marriage, confirming the strong relationship between economic stress and family planning, hence further supporting former research.[62] Only the first period for Sart does not support this hypothesis. The reasons for that, however, do not lie in resilience of the Sartians to economic stress. Instead, a convincing explanation comes from the unsatisfactory proxy for economic stress that 'is not local enough', the rather small number of

[62] Remember Galloway´s reference to 39 scholars alone who use this approach (Galloway 1988, pp. 278f).

events when compared to Würselen and Meersen, and from constraints that even go beyond the constraining power of economic stress on marriages as suggested by Oris et al., such as authoritarian parents, limited partner selection choice (ibid.), and the lack of ability to outsource caretaking of elderly parents.

Furthermore, Sart again remains the exception when comparing effect magnitude and effect size over time. Despite a larger number of observable events, both decrease for Würselen and Meerssen and show the lowest levels in the final period of the century during better years as well as during years of economic stress. Only in Sart have the institutions that attenuate economic stress contributed little, if at all, to reducing vulnerability to economic stress, as statistically significant economic stress variable effects even increase over time in this respect.

Overall, the most surprising result, however, remains the lack of disappearance of reactions to economic stress in any of the three communes. Thus, neither formal savings and credits, nor upgraded poor relief and the development of modern social laws, nor the adjustment of labour supply during the beginning phase of industrialisation suffice to fully protect the majority of the young couples from short-term economic stress. For some parts of society, such a very privileged status is either achieved much later or indeed never either.

In consequence, hypothesis 2 is only partly confirmed (H 2: *the border situation allows us to assume that stress-attenuating institutions, such as savings banks and modern social security, appear at different times for the three communes. At one point in time, according to their emergence, the connection between economic stress and delaying marriage will disappear, first in one commune, then in a second and eventually in the third commune*).

Namely, the reconstruction of the relevant institutions has indeed revealed a difference when the most of the formal institutions emerge in the three communes. Moreover, vulnerability to economic stress decreases over time in Würselen and especially in Meerssen, coinciding with the fact that an increasing number of formal stress-attenuating institutions are in place the longer the century lasts. However, as described, the connection between economic stress and delaying marriage was never fully present.

The fact that Meerssen shows a lower vulnerability to economic stress particularly in the last period of the century, despite Würselen´s more favourable formal economic stress-attenuating institutional circumstances (remember the availability of successful savings banks and the early established social laws), points to more endogenously, family-based factors and constraints that

hindered marriages in the latter commune. Namely, ties to both parents and older siblings loosen to a smaller extent in Würselen than in Meerssen, pointing towards a somewhat more stable family structure in Würselen. This, in turn, also meant that the more stable family characteristics in Würselen are countered by the early appearance of modern formal institutions. In comparison, for the Meersseners inner family processes mainly ease out economic stress in the long run, enabling them to support themselves in times of hardship. Given that the correlation of higher wheat prices and marriage remain throughout, however, public poor relief or modern social laws cannot be identified to be the main drivers for reduced marriage constraints. While these institutions surely attenuated pauperisms and mortality in the long run by helping individuals in danger of not meeting his or her very basic needs such as food or clothes, they are not designed to go beyond these goals. A marriage, requiring the building up of a marriage fund, in other words savings, however, does exactly that.

An overall surpassing of the Malthusian preventive check cannot be attested for Sart either. Hence, though Sartians have the highest age at first marriage, they too remain vulnerable to short-term economic stress. A high mean age of marriage and, more generally speaking, the EMP is unable to grant economic success alone, differing to claims by de Moor and van Zanden (de Moor and van Zanden 2010). Further supporting Edwards and Ogilvie´s as well as Dennison and Ogilvie´s counterclaims, this finding suggests that the institutional and economic environment in which the EMP is embedded in is much more important to explain economic development: "[l]ate age at first marriage may only have been possible in a framework of strong non-familial institutions that could substitute for families in providing labour, insurance, welfare, and old age care to unmarried individuals and fragile […] families" (Edwards and Ogilvie 2018, p. 6; Dennison and Ogilvie 2013). Somehow reclassifying this statement, the results for Sart indicate that marriage behaviour here is not as much related to institutions as it is for Würselen and Meerssen. Savings banks and institutions providing small credit do also appear in the last period in Verviers, however, they appear too late to have enough of an impact on the Sartians who never marry independently from short-term economic stress. In consequence, the rather meagrely developed "nonfamilial institutions that circumscribed both demographic and economic decisions during European economic development" (Dennison and Ogilvie 2013, p. 33) cannot provide individuals and couples in Sart with enough possibilities to profit from marriage delay.

In sum, on the one hand, late age at marriages is not only possible "in a framework of strong non-familial institutions" (Edwards and Ogilvie 2018, p. 6). Instead, it is the result of all sorts of external constraints. But late marriage in a framework of weak family ties and strong non-familial institutions, on the other hand, foster resilience to exogenous economic pressure.

Hypothesis 3 (H 3: When further analysing the different layers of society, […], *we would expect the richer strata of society to marry independent from overall economically worsening conditions. For the lower strata of society, instead, we would expect visible vulnerability.)* has to be partly rejected for the richer and confirmed for the poorer strata. While the richer strata, represented through elite and the lower middle class, does indeed react to economic stress in Würselen throughout the century, their vulnerability can no longer be proved in Meerssen by the end of the century. The Meersseners seem to be forerunners in Therborn´s sense of pioneers, meaning social groups with high levels of agency (cf. Therborn 2004, p. 242), who first managed to achieve family planning independent from economic stress (see again 5.2.2). The formal institutions accountable for that, again, cannot be found in the improvements in poor relief or modern social security as the upper class would not be considered as needy. More plausible explanations for these developments in Meerssen in the late 19th century can instead be linked to savings banks and functioning credit markets (Fertig 2003b, p. 226) that allowed for the acquiring of the farm from elderly parents and maybe also for paying off siblings in families where impartible inheritance was not fully applied (anymore).

The lack of evidence and possible interpretations for Sart is related to the scarcity of cases. The full model with interactions for Sart has shown rather large effects for economic stress on the marriage behaviour for the lower middle class but remains without statistical significance. Instead, for all three communes it is especially the poorer strata of society that clearly show a strongly visible vulnerability to economic stress throughout the century. Despite this, the above-mentioned decreasing effect sizes point towards ameliorations in that respect, though not yet allowing for a completely non-Malthusian demographic behaviour.

Hypothesis 4 (H 4: [...] *a farmer who still produces surpluses during bad harvest years would rather profit from such years as corn prices rise.),* in turn, is confirmed. By taking farmers as the reference category for analysing reactions to economic stress by the different social layers, it becomes clear that the farmers are indeed the least vulnerable to economic stress, confirming most

of the findings in the literature (EAP all volumes[63]). In fact, no layer of society is better off in years of economic stress when compared to the farmers. The farmers, thus, are indeed able to produce and sell surpluses and in consequence to profit in times of higher grain prices. This further supports both the finding that farmers´ estates mainly remained intact in Würselen and the assumption that they also did so in Meerssen through the inheritance to one male heir, often to the youngest son.
However, during better years in Würselen and Meerssen, in most of the cases, it is usually the other strata that are more likely to marry, pointing towards later marriages of farmers caused by the niche principle. Together with the fact that being the first-born son of the family has mainly positive influence on marriage timing too for all three communes, there are indications that there must be some truth in the niche-argument for the farmers. A large share of farmers would have to wait for a niche to become free, automatically delaying marriage during better years; a finding that supports Fertig´s view on the niche principle's place in some life cycles (Fertig 2003b, p. 110)
The fact that the lower strata in Sart, with reference to the farmers, are under pressure during better years too, further illustrates their hardships throughout the century. Even in better or more favourable economic years, many lack the opportunity to set up the sufficient funds for marriage. However, while better years are more advantageous for the farmers in Sart, further supporting Medick´s view that each small piece of land is an asset (see again Medick 1997, p. 148), in turn, they are not able to profit from higher grain prices as the majority do not produce enough surpluses due to their relatively small farms.
The last hypothesis to test for marriages, hypothesis 5 (H 5: *It can therefore be expected that individuals and couples with weaker family ties would have more difficulties to marry in the early years of industrialisation. Members of families with stronger ties could consequently marry earlier in this period. The connection between strong family ties and advantages to marry will disappear with the development of institutions that attenuate economic stress*.) can be fully confirmed. Taking together what has been established for the effects of family members and the long-lasting presence of vulnerability to economic stress, it appears that particularly strong family ties between parents and children, as well as the dependence of children towards their patriarchal fathers' decision-making on inheritance, bind the resources of at least the lower strata of society to an extent that hinders marriage. Although all of the three communes show signs of weakening family ties,

[63] For fertility see Tsuya et al. 2010, pp. 181, 184.

especially in Sart but also in Würselen, the development has never progressed to the extent to allow a significant increase of resilience to economic stress. This finding is also backed up by the larger share of migrants for Meerssen. Following Moring´s findings, the present study does not confirm Reher's view of the family being rather unimportant in northern Europe (Reher 1998; see Moring 2008, p. 115). Instead, according to their role within the family, close family members either impede or promote marriage across the Border Triangle. Consequently, the situation changes the most and appears to be most favourable for the Meersseners by the end of the century, when family ties are rather weak and vulnerability to economic stress is decreasing. Namely, in a phase of an ever-accelerating industrialisation that leads to smaller, more industrious families gaining the advantage (Hajnal 1982, pp. 476-481; cf. Heady and et al. 2004), it is the strong ties to family members that remain an obstacle for young couples (ibid). This development from higher constraints to lower constraints of marriage in Meerssen fits very well into the existing literature: according to Oberndorff and Niesten, the large patriarchal family with unmarried brothers, sisters, servants and maids was the core of the community in Limburg in the first half of the 19th century. The relationship between such families was generally very strong (Oberndorff and Niesten 1994, p. 172). Throughout the century, then, the historical changes we observed in chapter IV occurred. Families would adapt to the new situation (Weir 1984, p. 35) and traditional notions of kinship begin to break down (Cummins 2009, pp. 63ff). With Meerssen being the forerunner of the three communes in terms of loosening family ties, the Meerseners are able first to catch up to the Würseleners and then to even surpass them in an overall lower vulnerability to economic stress.

Positive effects of parental deaths are observable for all three communes, indicating that taking care of a parent during old age must have been a major drawback for young couples. Those who could outsource caretaking were therefore better off. Although an explanation for this could be that the patriarchy is a driving force for marriage constraints, instead, marriage-related reactions should be expected to be more independent from economic stress as they actually were in Würselen, where the authority of the parents remains rather strong throughout the century. For Sart, however, as shown above, such indications are indeed visible, especially during early industrialisation. Indeed, Sartians only enter a period of visible vulnerability to economic stress when patriarchy levels and family ties in general begin to decrease.

5.5 A Full Model of the Region

Before drawing final conclusions, a full model for the entire region will be established. In doing so, it becomes possible to reveal further differences between the three villages, while checking if the results obtained above can be further supported. In the same style as above, first a model without interaction will be provided followed by a model with interactions, the interactions this time being with a newly constructed village variable. A few cases are lost though when merging due to differences in the beginning year and end year of each data set (beginning: Sart 1811, Meerssen 1816, Würselen 1815, end: Sart 1890, Meerssen 1899, Würselen 1899), reducing the events from 8239 to 7675. The decision was also made to exclude the contextual variables for savings banks and credit institutions as these technically divide the respective datasets into sub-periods. A first-born variable is obsolete in these models due to the introduction of the n_Older_Siblings2 variable which automatically categorises the “no” group as first-borns. The results of the full model are the following:

Results Table 15: Cox Regression Estimates (Relative Risks of Marrying): Unmarried Men 18 to 50 Years, Full Adapted Model without Interactions, Border Triangle 1810 – 1899

Number of events = 3793

		coef	exp(coef)	se(coef)	Chisq	p	
Price_Cycle_Wheat		-0,292	**0,747**	0,127	5,270	**0,02**	*
Fath_Dead							
	FALSE		**1 (ref)**				
	TRUE	0,104	**1,110**	0,045	5,480	**0,02**	*
	NA	0,080	**1,083**	0,055	2,110	**0,15**	
Moth_Dead							
	FALSE		**1 (ref)**				
	TRUE	0,066	**1,068**	0,049	1,790	**0,18**	
	NA	0,059	**1,061**	0,052	1,290	**0,26**	
Hisclass5Farmers			**1 (ref)**				
Hisclass5LowerClass		0,112	**1,119**	0,058	3,730	**0,05**	.
Hisclass5UpperClass		-0,057	**0,945**	0,093	0,370	**0,54**	
n_Older_Siblings2	**No**		**1 (ref)**				
	Yes	-0,234	**0,792**	0,040	33,300	**0,00**	***
Village:Meerssen			**1 (ref)**				
Village:Sart		-0,101	**0,904**	0,071	2,040	**0,15**	
Village:Würselen		0,059	**1,060**	0,036	2,650	**0,10**	
frailty(id)					0,190	**0,40**	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 25 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -30369.8
Degrees of freedom for terms= 1.0 1.0 2.0 2.0 2.0 1.0 2.0 0.2
Concordance= 0.545 (se = 0.545)
Likelihood ratio test= 77.65 on 11.19 df, p=5e-12

Results Table 16: Cox Regression Estimates (Relative Risks of Marrying): Unmarried Women 16 to 50 Years, Full Adapted Model without Interactions, Border Triangle 1810 – 1899

n= 83903, number of events= 3882

		coef	exp(coef)	se(coef)	Chisq	p	
Price_Cycle_Wheat		-0,309	**0,734**	0,125	6,110	**0,01**	*
Fath_Dead							
	FALSE		**1 (ref)**				

	TRUE	0,096	**1,101**	0,041	5,440	**0,02**	*
	NA	-0,116	**0,891**	0,052	4,910	**0,03**	*
Moth_Dead							
	FALSE		**1 (ref)**				
	TRUE	0,177	**1,194**	0,046	14,730	**0,00**	***
	NA	0,008	**1,008**	0,049	0,030	**0,87**	
HIsclass5Farmers			**1 (ref)**				
Hisclass5LowerClass		0,283	**1,328**	0,207	1,880	**0,17**	
Hisclass5UpperClass		0,049	**1,051**	0,277	0,030	**0,86**	
n_Older_Siblings2	**No**		**1 (ref)**				
	Yes	-0,226	**0,798**	0,037	37,310	**0,00**	***
Village:Meerssen			**1 (ref)**				
Village:Sart		-0,070	**0,933**	0,066	1,110	**0,29**	
Village:Würselen		0,206	**1,229**	0,036	33,040	**0,00**	***
frailty(id)					0,190	**0,40**	

Signif. codes: 0 '*' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1**
Iterations: 5 outer, 26 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -30900.2
Degrees of freedom for terms= 1.0 2.0 2.0 2.0 1.0 2.0 0.2
Concordance= 0.554 (se = 0.554)
Likelihood ratio test= 150.8 on 10.19 df, p=<2e-16

The results for the region as a whole reveal that higher prices of grain lower the chances for marriage for the entire region. This is an issue throughout the entire 19th century for both men and women. Moreover, both men and women marry earlier if a father died. The Moth_Dead variable also shows results similar to those discovered above, where it was found for Würselen and Sart that a dead mother somewhat relieves restraints from the family in terms of caretaking obligations. Therefore, the death of a mother especially increases the chances of marriage for women. Lower-class men would marry sooner and more often than farmers, which again supports the idea of the niche principle for the latter. Having any number of older siblings instead lowers the chances of marrying for both sexes, meaning that first-borns have some advantages here in general. The three villages compared reflect findings in the descriptive statistics, namely that Würseleners have the best chances for marriage throughout most of the century, with the effects for women being both large and strong and for men almost statistically significant at the 90% level. What is not shown

in this model, then, is that this fact is turned around in favour for Meerssen the longer the century lasts, as seen and discussed above.

Results Table 17: Cox Regression Estimates (Relative Risks of Marrying): Unmarried Men 18 to 50 Years, Full Adapted Model with Interactions, Border Triangle 1810 – 1899

Number of events = 3793

		coef	**exp(coef)**	se(coef)	Chisq	**p**	
Price_Cycle_Wheat		-0,300	**0,741**	0,199	2,27	**0,13**	
Fath_Dead							
	FALSE		1 (ref)				
	TRUE	0,022	**1,022**	0,085	0,06	**0,80**	
	NA	0,377	**1,459**	0,100	14,28	**0,00**	***
Moth_Dead							
	FALSE		1 (ref)				
	TRUE	-0,111	**0,895**	0,095	1,36	**0,24**	
	NA	-0,186	**0,830**	0,097	3,67	**0,06**	.
HIsclass5Farmers			1 (ref)				
Hisclass5LowerClass		-0,008	**0,992**	0,088	0,01	**0,92**	
Hisclass5UpperClass		-0,055	**0,947**	0,126	0,19	**0,66**	
n_Older_Siblings2	**No**		1 (ref)				
	Yes	-0,166	**0,847**	0,065	6,48	**0,01**	*
Village:Meerssen			1 (ref)				
Village:Sart		-0,045	**0,956**	0,163	0,08	**0,78**	
Village:Würselen		-0,464	**0,629**	0,158	8,65	**0,00**	***
frailty(id)					0,19	**0,40**	
Price_Cycle_Wheat:Meerssen			1 (ref)				
Price_Cycle_Wheat:Sart		0,678	**1,971**	0,545	1,55	**0,21**	
Price_Cycle_Wheat:Würselen		-0,095	**0,909**	0,266	0,13	**0,72**	
Fath_Dead:Meerssen			1 (ref)				
Fath_Dead:Sart_Yes		0,352	**1,421**	0,166	4,49	**0,03**	*
Fath_Dead:Sart_NA		-0,443	**0,642**	0,207	4,58	**0,03**	*
Fath_Dead:Würselen_Yes		0,064	**1,066**	0,102	0,39	**0,53**	
Fath_Dead:Würselen_NA		-0,448	**0,639**	0,125	12,80	**0,00**	***
Moth_Dead:Meerssen			1 (ref)				
Moth_Dead:Sart_Yes		0,401	**1,494**	0,176	5,18	**0,02**	*
Moth_Dead:Sart_NA		0,093	**1,098**	0,190	0,24	**0,62**	
Moth_Dead:Würselen_Yes		0,207	**1,230**	0,114	3,30	**0,07**	.

Moth_Dead:Würselen_NA		0,351	**1,420**	0,118	8,77	**0,00**	***
Hisclass5:Meerssen			1 (ref)				
Hisclass5:LowerClass:Sart		-0,280	**0,756**	0,155	3,25	**0,07**	.
Hisclass5:UpperClass:Sart		-1,214	**0,297**	0,597	4,14	**0,04**	.
Hisclass5:LowerClass:Würselen		0,595	**1,813**	0,147	16,40	**0,00**	***
Hisclass5:UpperClass:Würselen		0,367	**1,444**	0,214	2,95	**0,09**	.
n_Older_Siblings2:Meerssen			1 (ref)				
n_Older_Siblings2:Yes:Sart		-0,159	**0,853**	0,187	0,72	**0,40**	
n_Older_Siblings2:Yes:Würselen		-0,073	**0,929**	0,082	0,81	**0,37**	

Iterations: 5 outer, 27 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -30329.8
Degrees of freedom for terms= 1.0 1.0 2.0 2.0 2.0 1.0 2.0 0.2 2.0
Concordance= 0.555 (se = 0.555)
Likelihood ratio test= 157.6 on 27.19 df, p=<2e-16

Results Table 18: Cox Regression Estimates (Relative Risks of Marrying): Unmarried Women 16 to 50 Years, Full Adapted Model with Interactions, Border Triangle 1810 – 1899

n= 83903, number of events= 3882

		coef	**exp(coef)**	se(coef)	Chisq	p	
Price_Cycle_Wheat		-0,385	**0,681**	0,220	3,05	0,08	.
Fath_Dead							
	FALSE		**1 (ref)**				
	TRUE	0,142	**1,153**	0,078	3,33	0,07	.
	NA	-0,052	**0,950**	0,095	0,29	0,59	
Moth_Dead							
	FALSE		**1 (ref)**				
	TRUE	0,270	**1,311**	0,088	9,52	0,00	***
	NA	-0,194	**0,824**	0,093	4,34	0,04	*
HIsclass5Farmers			**1 (ref)**				
Hisclass5LowerClass		0,260	**1,297**	0,318	0,67	0,41	
Hisclass5UpperClass		-0,065	**0,937**	0,399	0,03	0,87	
n_Older_Siblings2	**No**		**1 (ref)**				
	Yes	-0,249	**0,780**	0,064	15,08	0,00	***
Village:Meerssen			**1 (ref)**				
Village:Sart		-0,061	**0,940**	0,443	0,02	0,89	

Village:Würselen		-0,295	**0,745**	0,776	0,14	0,70	
frailty(id)					0,19	0,40	
Price_Cycle_Wheat:Meerssen			**1 (ref)**				
Price_Cycle_Wheat:Sart		0,288	**1,333**	0,528	0,30	0,59	
Price_Cycle_Wheat:Würselen		0,099	**1,104**	0,273	0,13	0,72	
Fath_Dead:Meerssen			**1 (ref)**				
Fath_Dead:Sart_Yes		0,232	**1,261**	0,161	2,07	0,15	
Fath_Dead:Sart_NA		-0,142	**0,868**	0,198	0,51	0,47	
Fath_Dead:Würselen_Yes		-0,083	**0,920**	0,093	0,79	0,37	
Fath_Dead:Würselen_NA		-0,016	**0,985**	0,117	0,02	0,89	
Moth_Dead:Meerssen			**1 (ref)**				
Moth_Dead:Sart_Yes		-0,124	**0,884**	0,168	0,54	0,46	
Moth_Dead:Sart_NA		-0,140	**0,870**	0,191	0,54	0,46	
Moth_Dead:Würselen_Yes		-0,123	**0,884**	0,105	1,38	0,24	
Moth_Dead:Würselen_NA		0,349	**1,418**	0,112	9,78	0,00	***
Hisclass5:Meerssen			**1 (ref)**				
Hisclass5:LowerClass:Sart		0,011	**1,012**	0,436	0,00	0,98	
Hisclass5:UpperClass:Sart		0,190	**1,210**	0,868	0,05	0,83	
Hisclass5:LowerClass:Würselen		0,407	**1,502**	0,776	0,27	0,60	
Hisclass5:UpperClass:Würselen		0,737	**2,089**	0,872	0,71	0,40	
n_Older_Siblings2:Meerssen			**1 (ref)**				
n_Older_Siblings2:Yes:Sart		-0,170	**0,844**	0,188	0,82	0,37	
n_Older_Siblings2:Yes:Würselen		0,004	**1,004**	0,080	0,00	0,96	

Iterations: 5 outer, 27 Newton-Raphson
Variance of random effect= 5e-05 I-likelihood = -30876.3
Degrees of freedom for terms= 1.0 2.0 2.0 2.0 1.0 2.0 0.2 2.0 4.0 4.0 4.0 2.0
Concordance= 0.564 (se = 0.564)
Likelihood ratio test= 198.5 on 26.19 df, p=<2e-16

The full model with interactions combines the village variable with the variables established above. This makes it possible to explain the different reactions of each village. A deceased father increases the risk of marriage for Sartian men, pointing towards a still significant niche system particularly in this more rurally-structured environment. When comparing the village-effects of the death of the mother, the NA cases reveal significant results, possibly pointing towards more migrants in Würselen whose relatives could not be matched. The increasing probability for marriage because of a deceased mother in Sart in turn points to the necessity of replacing her as an additional income provider, supporting the view of Sart as the poorest among the three villages. The lower and the higher strata of men in Sart are the worst-off in this model when compared to Meerssen. Both strata, however, have higher chances of marrying in Würselen for most of the 19th

century but again without accounting for the above-observed shift towards its end. For women, no statistically significant effects were found. A reason could be that men generally marry less for status. The presence of older sibling remains the above-mentioned arbitrary, unclear mixture of supporting and opposing their siblings. No significant effects are found here for either sex.

After all these efforts, the results obtained were not as manifold as desired. When accounting for all the 15 models created, many effects remain small or have low statistical significance. Similar to Bengtssons analysis of the timing of first marriage and the response to fluctuations in grain prices, the models were possibly still too simplistic to gather stronger results. Neither in Bengtsson´s study nor here can the postponing of their children's marriages be classified as a very efficient measure for parents to reduce the negative impact of short-term economic stress. I follow Bengtssons' examination of the model types used here in summarising that the results show weaknesses of the predominant savings model, in which the chances of marrying depend on the opportunities among the unmarried only. Thus, even more sophisticated models are needed that possibly take several generations into account, which focus more on the family level and look more specifically into the producers/ workers relations (cf. Bengtsson 2014, p. 150, 165). Despite the differences of the model applied here, the discussion has still revealed some important results. Using the following summary table, the findings can be transposed into a reader-friendly overview, thus helping to answer the overall research question:

Table 40: Results and Discussion Summary

	Hypothesis (Core)	**Würselen**	**Meerssen**	**Sart**	**Statistical Evidence**
H1	Postponing of marriages when economic stress occurs	Yes	yes	Yes	high
H2	Finally resilient against economic stress	No	no	No	high
	Decreasing vulnerability to economic stress	*yes, slightly*	*yes*	*No*	*moderate*
H3	Richer strata act independent from economic stress	No	yes, later in time	-	moderate
H4	Farmers profit from economic stress	Yes	yes	yes, slightly	high
H5	Weakening family ties facilitate marriage during industrialisation	yes, slightly	yes	yes, slightly	moderate

Source: own illustration

The Hypothesis (Core) column summarises the core statement of every hypothesis. H2 has been modified (in italics) since it was partly rejected. For each commune, the respective "yes" and "no" findings revealed by our analysis are additionally classified with their level of statistical significance. The summary illustrates clearly: delaying marriages has been a major means to cope with exogenous economic stress throughout the entire 19th century which institutions could not fully buffer. This non-resilience to economic pressure points towards a necessary combination of both formal modern institutions *and* loosening family ties that could enable the people of the Border Triangle to overcome the Malthusian trap.

However, the fact that Würselen too remains vulnerable to economic stress despite the availability of savings banks and credit institutions, Europe´s most advanced social security system, and additionally somewhat weakening family ties, it is reasonable to also assume that delaying marriages might in fact not be independent from economic stress at all for some strata. It might be the case that pre-industrial Malthusian vulnerability does indeed transform marriage timing into deliberate planning, a planning that is not truly independent from external economic factors but less subjected to it.

When now accounting for all what has been worked out for the Border Triangle, the overall research question can be asked again and finally be answered:

Which institutions trigger the emergence of heterogeneity in individuals´ and couples´ demographic decision-making under economic pressure at the dawn of the industrial revolution? How does the interplay of these attenuating counter-institutions shape their responsiveness to economic stress?

The analysis has shown that only some formal institutions, in combination with some informal ones, contributed to such differentiation. Clearly, there is not one "master institution" that can solely be held responsible for disparities in demographic decision-making during the process of industrialisation. Instead, it is a complex mixture of several means, ranging from social aid to self-aid, a `mixing of various strategies´ (Kok 2002, p. vii), that finally allowed the overall improvement of living conditions. On the one hand, the mutual *interplay* of formal institutions such as savings banks and credit banks helped to build up savings and to create functioning credit and land markets within the family (Fertig 2003b, p. 226, 2013). On the other hand, it is especially

those institutions that are related to transfers through the collective (Laslett 1983; Reher 1998), which is here mainly outsourced caretaking for the sick and elderly, that most relieve the barriers for marriage. When tracing the example of Meerssen, the most successful measures are on the communal level, such as local institutions for the elderly and sick, local possibilities for making money at a young age through lifecycle servanthood, and a range of local possibilities for "cash flow juggling" (pawn shops, savings and credit banks, insurance). This approach that emphases local policies might serve as an illustrative example for future EU-policies. However, the slow yet continuous erosion of an older institution, namely that of larger and strongly-tied core families has a large share in this ameliorating situation for individuals and young couples too. Adaptation here is key. Thus, it is the mixture of both formal and informal institutions together with rather loosely-tied core families that create an environment of independent couples who are able to adapt to the upcoming and accelerating industrialisation, to cope with daily crises, and to take chances in times of growth.

When now comparing this small piece of European land with the eastern Asian ones of the EAP, the results can now finally be integrated into the bigger picture. Already during the reconstruction of the historical context and institutions, it was clear that neither property rights nor inheritance laws could explain divergences in demographic behaviour. Instead, as found by Lee et al., actually applied inheritance practices and possibilities influenced demographic responses in Europe decisively (Lee et al. 2004a, p. 19). While for some Europeans, mainly the first- (or last-) born farmers (and possibly some first-born craftsmen), a niche principle delayed marriage on the one hand, while also providing the newly established family with funds to cope with crises on the other hand. Most of the other Europeans, however, were also often forced to marry later than their peers in east Asia due to the necessity of setting up a marriage fund themselves. Crises could be overcome more easily where additional capital accumulation possibilities for building up such a fund were available (Fertig 2003b, p. 226), through savings banks and lifecycle servanthood for instance, where a large degree of self-determination was given, and where industrialisation occurred that allowed for exploiting these advantages. In east Asia, instead, the more pronounced patriarchy and hierarchy inside the household ensured a system that changed less, which resulted in a more stable environment, yet with less economic possibilities.

Following this higher agency as one major explanation for the diverging paths of Europe and east Asia, other facts give further support to these findings, such as women´s participation in the labour

market as suggested by de Moor and van Zanden (de Moor and van Zanden 2010, p. 27), and lifecycle servanthood. Namely, the labour markets were found to be very much alike in the Border Triangle both in its liberal character and in the opportunities for women to work. The only difference found here was in the very low share of female lifecycle servants in eastern Belgium, leaving the Sartians poorer and Sart´s women more dependent on their men (remember also the rather high age differences between the partners here). Life cycle servanthood, thus, has its share in adding to the overall divergence between Europe and Asia. The fact that women wait out economic stress longer than men may additionally point towards more preventively-acting women in Europe.

However, all in all, geography, ecotypes, and especially family characteristics and ties in combination with possible outsourcing of constraints to the community with many different opportunities (savings banks, small credits, relief for the poor and social security to some extent) serve best to explain diverging paths: geographic isolation without natural resources offers less opportunities for industrial activity and leaves remote places with only slowly improving living standards. For industrialisation to occur, the supply of a large and low-skilled workforce is necessary. For industrialisation to gain pace, then, skilled workers become more important. With the industrialisation taking off, weaker family ties together with a weaker patriarchy facilitates the flexibility and chance-taking necessary to adapt to and act in the rapidly changing environment of 19th century Europe. European families of such or similar types allow this flexible "adaptive family economy" (Wall 1986) that employ both kin and non-kin as a labour force, the latter being easily adjustable in itself (see also Schlumbohm 2009, p. 98f). Additionally, the 'mixing of various strategies' (Kok 2002, p. vii) to cope with crises and the specific lifecycle of these more adaptive families facilitates capital accumulation that in the long run led to increased overall wealth of the region (for the effects on capital accumulation and macro-economic wealth see again Jones 1981, pp. 15ff; Voigtländer and Voth 2006, pp. 347f; Foreman-Peck 2011). In east Asia, instead, strong family ties and a family structure that attenuates economic stress a priori ultimately impedes incentives to take matters into ones´ own hands. The early economic take-off of the West, and its persisting role as economical leader with high living standards when compared to the East and other parts of the world can be partly explained this way.

To close, it must be added, however, that demography and its interaction with formal and informal institutions can only provide a share in this explanation. Surely the theoretical explanations alluded

to in chapter I, such as innovation, colonialism, luxury consumption, property rights, culture, political fragmentation, all play their part in the early economic take-off of the West. And while studying all of these explanations is far beyond the scope of this study, it was shown that 'good and bad' political behaviour and institutions, as suggested by Acemoglu and Robinson (Acemoglu and Robinson 2012), do indeed have a considerable impact on economic development. They can also serve as an instrument for attenuating economic stress. This study has shown one way of how to really measure this institutional impact on economic and related demographic developments.

VI Summary and Conclusions

My study on "Coping and Caring: Institutions, Transition, and Families under Economic Pressure" began with a thematic introduction into the topic of economic history and historical demography including one of its most debated matters, namely that of economic inequalities. Furthermore, I presented my overall research question examining the impact of institutions on differences in demographic behaviour. Then I described the setup and the goals of the present study: from a New Institutional Economics perspective, the study aimed on the one hand to elaborate and test a new way of measuring institutional impact on demographic decision-making. On the other hand, a second main goal was to explain individuals´ and couples´ demographic decision-making under exogenous economic pressure. Hereby, in turn, special focus was given to formal and informal institutions with their function to attenuate pressure from people in three selected localities. The Border Triangle of Belgium, The Netherlands, and Germany marked the field site in which the three case studies were located – Würselen (Germany), Meersen (the Netherlands), and Sart (Belgium).

In the second chapter I introduced and defined the main concepts used in this study and prepared the ground for their further application. Hereafter, I provided a critical review of the grand theory of the Malthusian Paradigm and the recent literature in the field of historical demography. From this base, then, it was possible to develop both the hypotheses that would later be tested statistically and an analytical framework that could be used to set the theoretical and practical parameters on the one hand and to organise the laboratory on the other. This framework further elaborated on what would constitute a crisis for individuals and couples in the 19th century, namely economic stress, and suggested possible coping strategies. These coping strategies, such as savings, borrowing, poor relief, adjusting labour force supply, and delaying marriages, were brought into connection with institutions that were potentially having a crucial impact onto those strategies. These institutions, in turn, were later evaluated in the analysis section.

In the third chapter, I outlined the methodology that was applied in this study: I explained both (1) the method for reconstructing the historical context and relevant institutions for the demographic development and (2) the theory behind the statistical models. This was followed by a detailed illustration of the applied technique of the event-history analyses that constituted the core of the statistical analyses in chapter V. Then, the contextual and mostly qualitative data as well as the

quantitative economic and demographic data used in this study were presented in depth and their quality and comparability were assessed critically. Also, the sampling and modelling strategy was explained in order to make the results of the present study understandable and possible to refute.
Chapter IV dealt with the history of the field site under research, the Border Triangle Belgium, The Netherlands, and Germany, and depicted both the political as well as the economic history of both the region in general and the specific case study communes of Würselen, Meerssen, and Sart. This chapter further included an in-depth reconstruction of historical and local realities and institutions for the 19th century, partly based on self-gathered archival sources. From here, it was possible to filter out those institutions which potentially had a significant impact on the demographic behaviour of the individuals and couples under research.
The fifth chapter finally applied what has been theorised, gathered, and analysed in the previous chapters: it presented a potential, innovative way of how to really measure the impact of institutions on demographic behaviour of individuals and couples. Represented through a delay in the "starting" of the families' reproductive phase (delaying marriages) (see Knodel 1987, p. 153), this behaviour was deconstructed through both descriptive and inductive statistical analysis. Then, the generated results were incorporated and analysed in the light of the communes´ and the regions´ historical context. In doing so, 'stylised facts' and a likely, "original `interpretation´" of "what 'really' went on" (Abend 2008, p. 178) could be given. In this way, the analyses provided enough evidence to answer the overall research question about *institutional triggers of the emergence of heterogeneity in individuals´ and couples´ demographic decision-making under economic pressure at the dawn of the industrial revolution.*
The study revealed that the most favourable situation to overcome Malthusian laws would be constituted by a setting that enables individuals and young couples to a 'mixing of various strategies' (Kok 2002, p. vii) in order to overcome economic pressure. Extending Deneweth et al.´s concept of informal "cash flow juggling" there is evidence for that on the one hand the *interplay* of formal *and* informal institutions created chances for such "cash flow juggling" (Deneweth et al. 2014, p. 89). *Together* with these, on the other hand, institutions that are related to transfers through the collective (Laslett 1983; Reher 1998) provided ever more individuals and young couples with possibilities to overcome economic pressure by themselves the longer the century lasts. The more institutions that help smoothen cash flow, such as pawn shops, savings banks, lifecycle servanthood, functioning credit and land markets within the family (Fertig 2003b,

p. 226), the more the erosion of strong family ties allowed individuals and couples to exploit these institutions, which in turn resulted in young families better adapting to the upcoming and accelerating industrialisation. Consequently, support from a larger, authoritarian, and strongly patriarchally organised family became less and less important. In fact, weakening family ties reduced the caretaking obligation of elderly and sick family members. Instead, it became possible and more popular to outsource caretaking obligations to public or private organisations. This, in turn, allowed elderly parents to take matters more in their own hands (cf. Bouman et al. 2012, pp. 21f) by reducing caretaking constraints from their children. Social security, of course, hereby remains a desirable backup by providing people with the chance to overcome bad times without being completely excluded from society. However, while improvements in poor relief and the emergence of modern social security are surely important for the chance to 'survive with a little help' (van Leeuwen 1993) and thus to reduce mortality, the results of the present study suggest that they contributed only little to the marriage planning of young couples.

To conclude, it is the mixture of these formal and informal institutions, constituting the framework around a demographic regime enabled to deliberately delay marriages, that provides the best shelter to externally caused economic pressure. Other than emphasised by Edwards and Ogilvie (Edwards and Ogilvie 2018, p. 7), the European Marriage Pattern (EMP) (Hajnal 1965) can substantially contribute to economic growth when the institutional framework allows the exploiting of related benefits. Thus, only by including the specific EMP can the early economic take-off of the West and its persistent role as economical leader with the highest living standards in the world be sufficiently explained. Following this evidence, I would like to modify Dennison and Ogilvie´s claim that "evidence suggests that whether a society experienced economic growth depended not on its marriage or family pattern, but on wider characteristics of its economy and institutional framework" (Dennison and Ogilvie 2013, p. 32) into "the evidence found in this study suggests that whether a society experienced economic growth depended not *solely* on its marriage or family pattern, *but also significantly* on wider characteristics of its economy and institutional framework".

The fittest for the new age of industrialisation, to refer to Darwin and to finally come back to the quote that initialised this thesis, hence, was not the strongest, neither the strongest patriarch nor the one with the strongest family ties, but the most adaptable. It was the individual who both acted himself (or herself) through strategic family planning on the one hand and who also took the

increasing chances given by the state to cope with crises on the other. By trying to provide some of these new chances, be it savings banks or modern social law acts, the state´s administrations itself, in turn, began to acknowledge that the institutions in place are lacking or do not fulfil functions of attenuating crises, as was clearly revealed through the 'great sins' of child labour, 82-hour shifts, and low pay and pauperism caused by early Manchester capitalism. The situation in Europe, apparently, had to become especially bad in order to finally improve. It is necessary for policy makers to learn from these mistakes and to prevent their repetition during actual and upcoming revolutionary changes caused by 'the fourth industrial revolution´.[64] At the same time, it is also necessary to remember individual responsibility for any action and that neither a high income nor a modern welfare state, despite both being comprehensible goals, can replace the family as a source of (mental) stability, security, and support. It is these two complementary sides that the West had figured out to be of equal importance in a unique manner.

Limitations

The limitations of the investigation have been described in the course of the study: while the unequal distribution of source-material for the three case studies could be buffered rather well through additional archive work, the sometimes-unequal distribution of information within the individual data between Würselen and Meerssen on the one hand and Sart on the other leaves the study with some uncertainties about migration behaviour in the former two communes. For this reason, migration, itself a means to overcome economic pressure, could not be studied in the same way as marriage.

The results themselves were fair, first of all for the two communes of Würselen and Meerssen. However, possible limitations of discovering further reactions to economic stress were the result of either incomplete or too aggregated data for economic stress. Local price data, especially for Sart, would probably reveal more statistically significant results.

A few additional limitations are found in the measurements of the effects of some of the formal institutions on marriage behaviour, the most obvious here being savings banks and small-credit-giving institutions as these could only be analysed contextually. The results, therefore, remain a

[64] https://www.forbes.com/sites/bernardmarr/2016/04/05/why-everyone-must-get-ready-for-4th-industrial-revolution/#1ac893d23f90.

little speculative in this respect. The informal institution of family organisation and family ties could be well approximated, but would benefit from more individual data.

Natural limitations were also given by the individual data itself. Only by including all individuals of the Border Triangle in a single data base, a complete picture of the region could possibly be obtained. Furthermore, laws also restricted information density for many of the individuals who died in the 20th century. For complete curricula vitae of each individual of the 19th century, more time will have to pass.

Desiderata

The limits of the study have shown the need to analyse in more depth certain institutions that explain divergence in demographic responses to economic stress. While the study could demonstrate ways to really measure this institutional impact on economic developments and related demographic behaviour, more research has to be carried out in this direction: savings banks and small-credit-giving institutions, for instance, though reconstructed through both primary and secondary sources, could only be studied contextually. It is therefore desirable for future studies to focus on the economic-stress-attenuating function of one institution individually and in more in depth. This could be achieved for instance with savings banks by linking individual bank accounts to the individuals in the database. In his dissertation, Bracht (Bracht 2013) has taken the first steps into this direction. However, analysing this data through inductive statistics also remains desirable in his study. Another desirable measurement would be the impact of public and/ or church poor relief on personal poor relief accounts. Linking these to the specific individuals would surely reveal firm results.

New evidence could also be found in testing the stress-attenuating function of other institutions beyond the framework used in this study. Proxies for measuring specific cultural traits in the sense of Hofstede´s (Hofstede 1997[1991]) such as long- and short-term planning, for instance, are plausible too: the potential impact of such "soft" factors on saving behaviour, politics, and inheritance practices and in consequence on marriage behaviour is surely indicated by the present study (see again Coal and Wolf 1974, p. 27 and their example on 'hidden borders').

A related and crucial aspect to 'culture' and demography is that of religious denomination (Kok 2017). Though much fewer Protestants and Jews are living in the Border Triangle than Catholics,

it would be illuminating to also analyse these groups in order to compare their behaviour with the results obtained here.

Other reactions should be tested too. The constraints of resources for this study did not allow to test all of the possible demographic reactions to short-term economic stress. “Spacing” and “stopping” (Knodel 1987), of course, remain desirable to examine whether the fertility decline become visible. Further questions to study would be concerning mortality: would there be results comparable to that of the “starting” analysed here? Moreover, migration as a response to economic stress had to be excluded for reasons related to data structure. The Eurasia Project on Population and Family History has shown, however, that there is much evidence for migration being a main way to cope with economic stress (Oris et al. 2014, pp. 279ff).

Furthermore, the digitalisation of historical sources of all kinds will advance during the next decades, making larger studies possible. The present study has shown the usefulness and desirability of large datasets obtained through genealogical sources. For instance, statistical significance could be highly improved with more such data for Sart.

Finally, more case studies are needed in general. Studying another border triangle either in Europe or in Asia and comparing it to the Border Triangle Belgium, The Netherlands, and Germany would provide further insights into demographic behaviour of couples under economic stress, into their coping and caring strategies, and into the reasons for the early industrialisation and current economic leadership of the West.

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Prices from online sources*

Rye Cologne:
https://histat.gesis.org/histat/de/table/details/21C1267E2CAAF259ABD20627BD2F1B3E#tabelle
Wheat Cologne:
https://histat.gesis.org/histat/de/table/details/BC9C93BA6A2E7447A67208942C68EAB5#tabelle

Further online sources*

http://www.ru.nl/historicaldemography/research-projects/current-research-projects/virtual-folder/colonialism-inside out/.
http://www.familienbuch-euregio.de/euromap.html.
http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/32461
http://www.investopedia.com/terms/s/standard-of-living.asp#ixzz1VUli2yEI
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http://www.familienbuch-euregio.de/genius/php/ewoTopics.php?tam=Kahlen&tab=1&sub=PublicAll&sid=9972a5d538a4ebb7611a46b483986995&tid=
http://www.familienbuch-euregio.eu/genius/?person=93469
http://www.familienbuch-euregio.de/genius/php/ewoList.php
http://www.familienbuch-euregio.de/genius/php/ewoPage.php?tam=Kahlen&sub=PublicAll&page=1236&tree=0:1:2:3:4&showTable=1&all=0
https://www.WieWasWie.nl/en/sources/
https://www.coe.int/en/web/good-governance/
http://www.volkstellingen.nl/nl/volkstelling/jaartellingdeelview/VT184906/index.html
http://www.volkstellingen.nl/nl/volkstelling/jaartellingdeelview/VT189911/index.html
https://ourworldindata.org/fertility-rate#note-42
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* All finally checked the 22.02.2019

VIII Appendix

8.1 Additional Tables and Figures

Table 41: Existing Marriage, Birth, and Death Data 1800 – 1899* Copied to the Familienbuch Euregio

	Würselen				Meerssen		
	Existing	**Copied**	**%**		**Existing**	**Copied**	**%**
Marriages							
1800 - 1809	257	257	**100**		114	78	**68**
1810 - 1819	249	249	**100**		105	89	**85**
1820 - 1829	316	314	**99**		127	98	**77**
1830 - 1839	375	363	**97**		142	124	**87**
1840 - 1849	298	282	**95**		121	109	**90**
1850 - 1859	397	349	**88**		181	165	**91**
1860 - 1869	421	394	**94**		187	164	**88**
1870 - 1879	331	300	**91**		256	225	**88**
1880 - 1889	432	397	**92**		212	189	**89**
1890 - 1899	629	526	**84**		311	243	**78**
Marriage Certificates	**3705**	**3431**	**93**		**1756**	**1484**	**85**
Births							
1800 - 1809	1449	1436	**99**		388	338	**87**
1810 - 1819	1291	1273	**99**		467	439	**94**
1820 - 1829	1387	1374	**99**		500	458	**92**
1830 - 1839	1662	1635	**98**		580	518	**89**
1840 - 1849	1623	1597	**98**		612	576	**94**
1850 - 1859	1675	1645	**98**		701	650	**93**
1860 - 1869	1987	1965	**99**		897	809	**90**
1870 - 1879	2498	2405	**96**		1144	1028	**90**
1880 - 1889	2812	2709	**96**		1179	1048	**89**
1890 - 1899	3946	3645	**92**		1565	1331	**85**
Baptism Registers	**20330**	**19684**	**97**		**8033**	**7195**	**90**

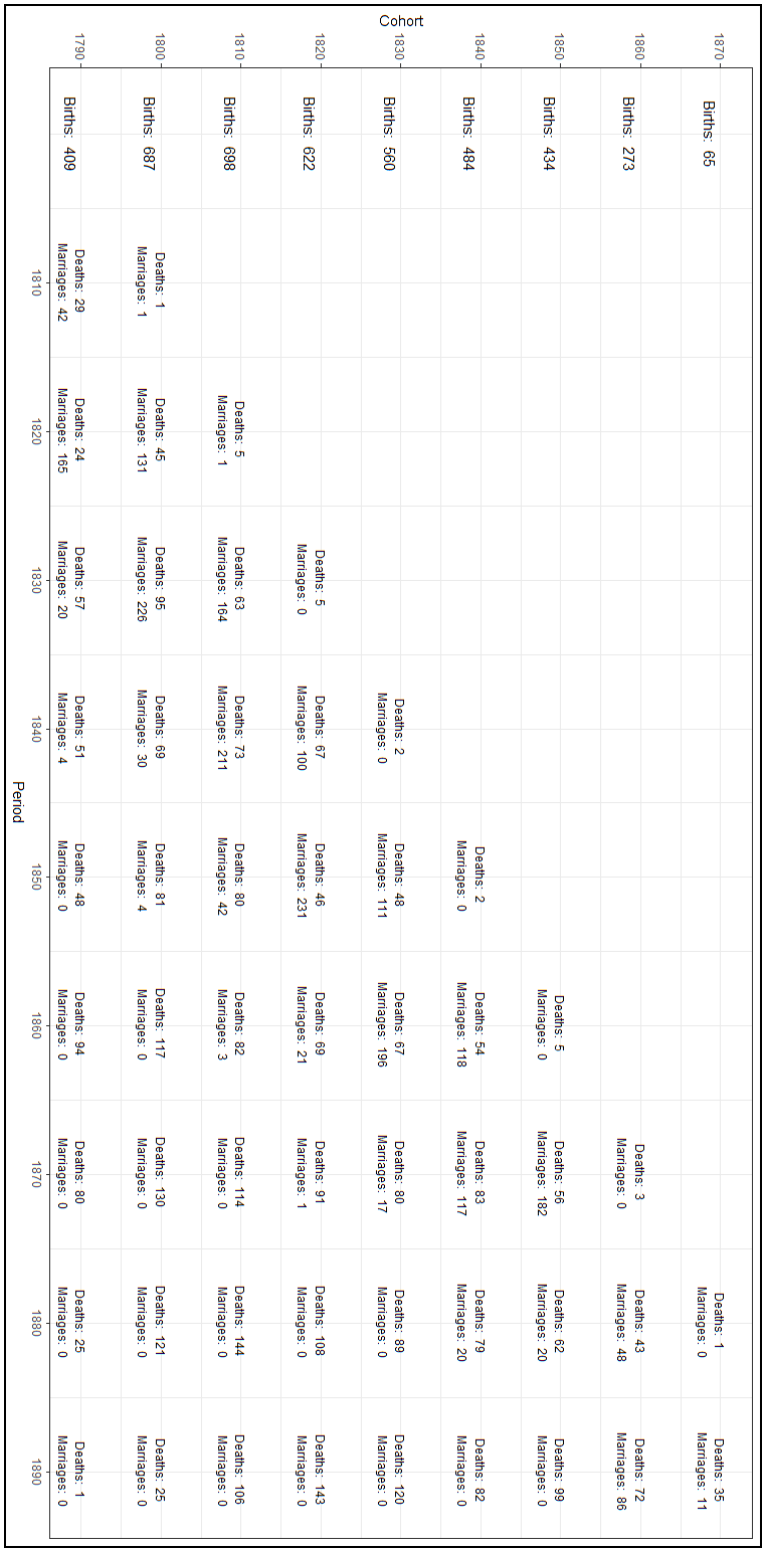
Deaths							
1800 - 1809	819	809	**99**		297	150	**51**
1810 - 1819	1082	1058	**98**		407	207	**51**
1820 - 1829	965	942	**98**		359	230	**64**
1830 - 1839	1335	1294	**97**		446	300	**67**
1840 - 1849	1300	1276	**98**		486	353	**73**
1850 - 1859	1289	1263	**98**		525	387	**74**
1860 - 1869	1446	1425	**99**		659	496	**75**
1870 - 1879	1798	1744	**97**		723	563	**78**
1880 - 1889	1713	1655	**97**		735	529	**72**
1890 - 1899	2173	2048	**94**		936	685	**73**
Death Certificates	**13920**	**13514**	**97**		**5573**	**3900**	**70**

*The data for Würselen in Table 41 are comprised by several primary sources:

- existing marriages: marriage certificates
- copied marriages: predominantly Catholic church books (marriage register) 80%, supplemented by marriage certificates 20%
- existing births: Catholic church books (baptisms)
- copied births: Catholic church books (baptisms) 99%, supplemented by birth certificates 1%
- existing deaths: Catholic church books (deaths)
- copied deaths: Catholic church books (deaths) 50%, supplemented by death certificates 50%

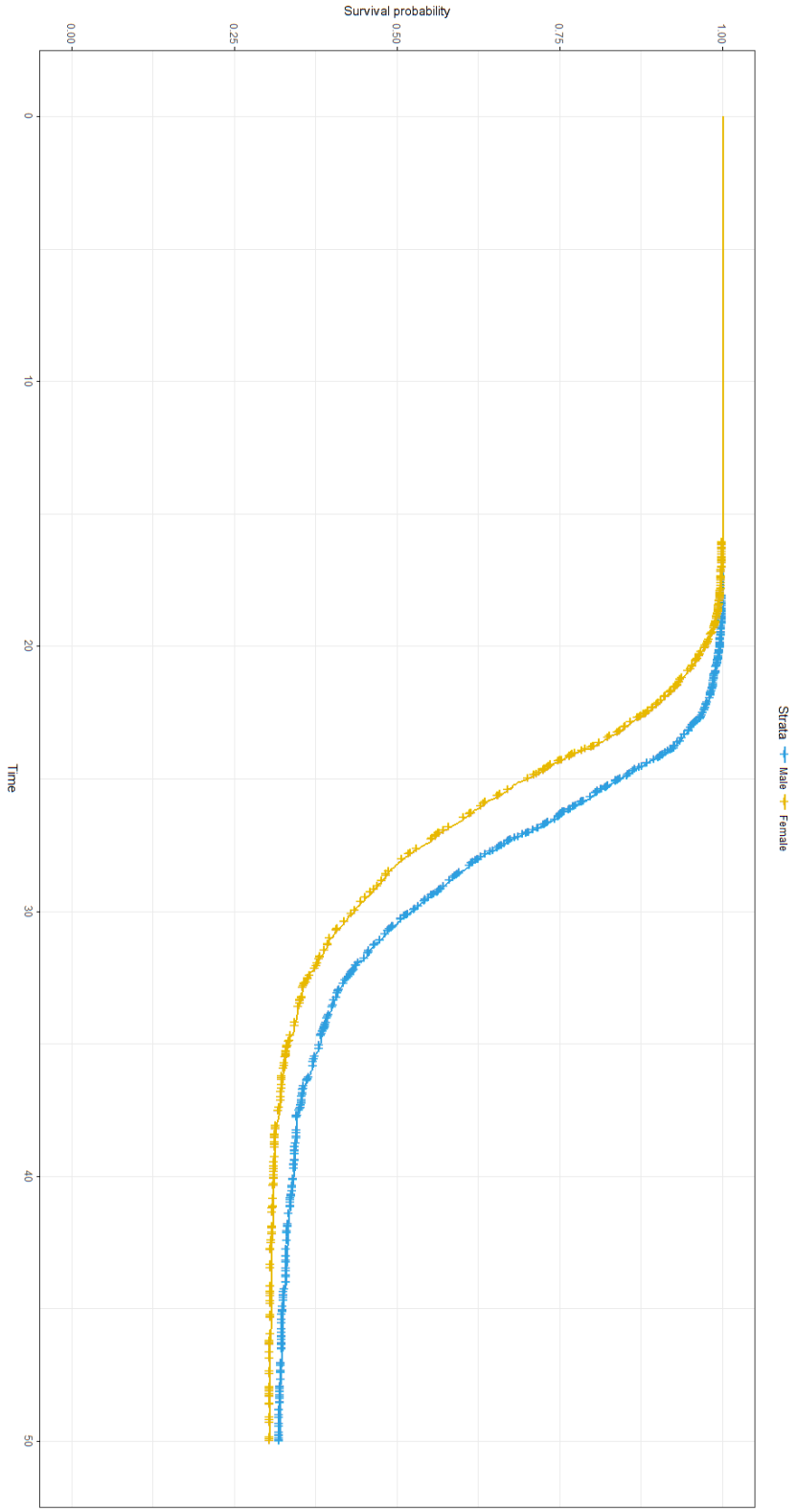
The data for Meerssen are comprised by Dutch civil registers, including birth certificates, marriage certificates and death certificates, no church book records have been used here.
Source: Familienbuch Euregio

Figure 24: Lexis Summary of Life Events in Würselen



Source: Familienbuch Euregio, own illustration

Figure 25: Probability of Not Marrying for Würseleners Born in Würselen 1810 – 1899

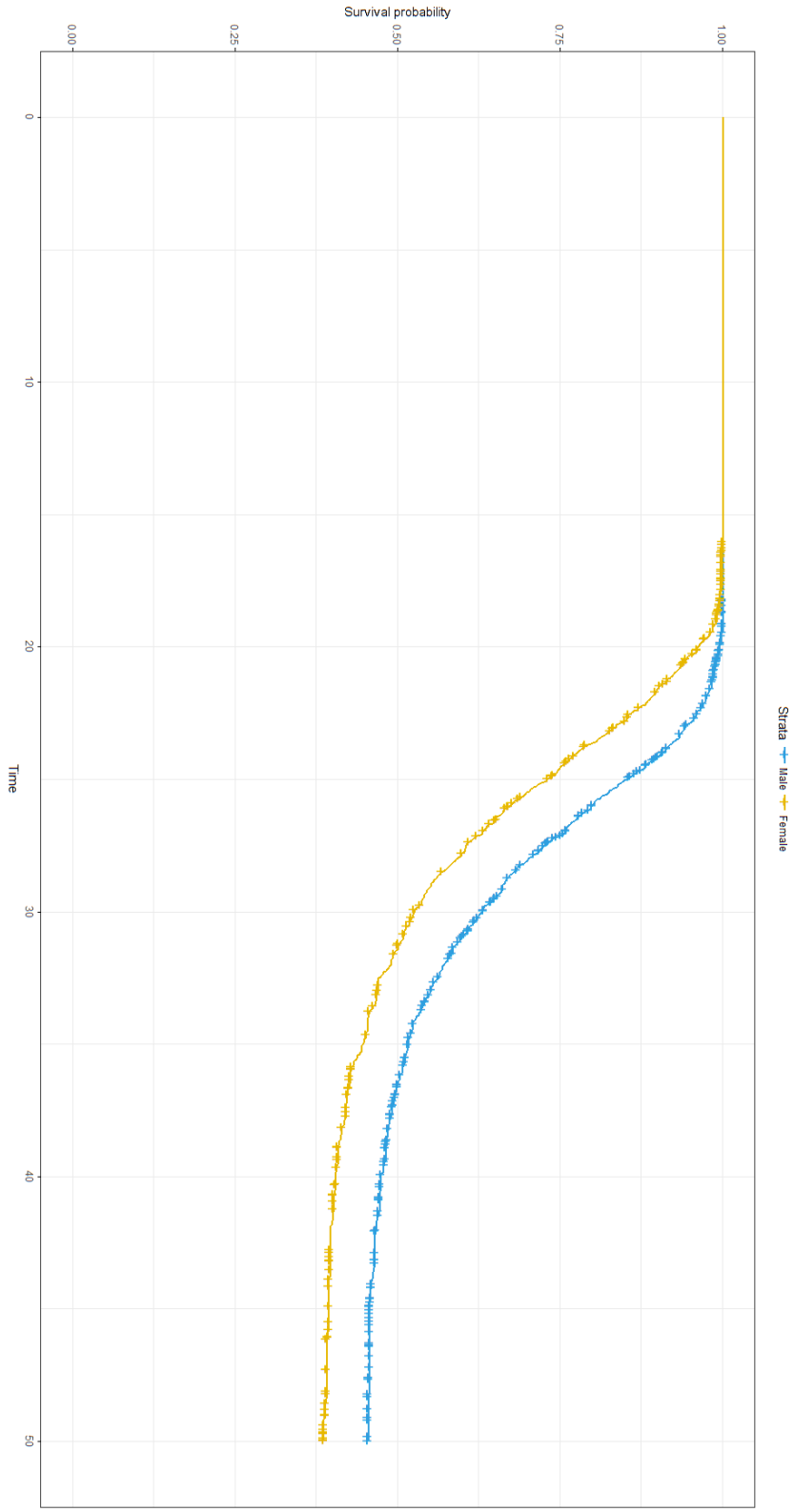


Source: Familienbuch Euregio, own illustration

Figure 26: Lexis Summary of Life Events in Meerssen

Source: Familienbuch Euregio, own illustration

Figure 27: Probability of Not Marrying for Meersseners Born in Meerssen 1810 – 1899



Source: Familienbuch Euregio, own illustration

8.2 Summary in German: Zusammenfassung – Deutsch

Die Dissertation “Coping and Caring: Institutions, Transition, and Families under Economic Pressure”, zu Deutsch “Durchkommen und (sich) kümmern: Institutionen, Wandel und Familien unter wirtschaftlichem Druck”, ist im Teilbereich Wirtschafts- und Demografiegeschichte der Geschichtswissenschaften angesiedelt. Ausgehend von der Neuen Institutionenökonomik–Perspektive werden in dieser Studie die Auswirkungen von exogenem wirtschaftlichen Druck auf das demografische Verhalten von Familien im 19. Jahrhundert untersucht. Hierbei im Fokus stehen die dieses Verhalten beeinflussenden Institutionen. Die Untersuchung war hierbei in sechs Kapitel unterteilt, eine Einleitung (I), ein Theoriekapitel (II), ein Kapitel zu Vorgehensweise und verwendeten Daten (III), ein Kapitel über das Untersuchungsgebiet (IV), das Analysekapitel (V) und ein abschließendes Kapitel (VI). Den Kapiteln des Hauptteils II-V wurde hier jeweils eine Kapitelzusammenfassung zugeordnet.

In der Einleitung der Arbeit wurde der Leser zuerst in das Thema eingeführt und über eine der bedeutendsten Debatten im Fachgebiet Wirtschafts- und Demografiegeschichte informiert, nämlich über die der wirtschaftlichen Ungleichheit zwischen (West) Europa und den anderen Teilen der Welt. Bezug wurde hierbei vor allem auf die Arbeiten des „Eurasia Project on Population and Family History” (kurz EAP) genommen. Dieses Projekt untersucht die Unterschiede in historischen Lebensstandards zwischen Europa und Asien durch die Fähigkeit von Individuen und Paaren kurzzeitlichen äußeren wirtschaftlichen Druck zu überstehen. Die Hauptannahme, dass jemand, der seine familiären Planungen, z.B. Heiraten, nicht umsetzen kann, wenn die wirtschaftliche Situation kurzzeitlich ungünstig ist, eher niedrige Lebensstandards hat (Bengtsson and Dribe 2002b), diente auch in der vorliegenden Studie als Ausgangspunkt zur Entwicklung der Forschungsfrage. Die zu beantwortende Forschungsfrage zielt hierbei auf die Rolle von formellen und informellen Institutionen zur Abfederung dieses wirtschaftlichen Drucks ab. Sie fragt: Welche Institutionen sind für das Entstehen von Unterschieden im Verhalten bei demografischen Checks unter wirtschaftlichem Druck im Verlauf der industriellen Revolution verantwortlich? Wie beeinflusst das Zusammenspiel dieser abfedernden Institutionen die Reaktionen von Familien auf wirtschaftlichen Druck?

Als Untersuchungsgebiet wurde das Dreiländereck Belgien, die Niederlande und Deutschland mit den drei wirtschaftlichen, städtischen Zentren Aachen, Maastricht und Verviers/ Liège vorgeschlagen. Da diese drei Städte erstens zu den frühindustrialisierten Zentren Europas gehörten

und somit Wandel observierbar wird, zweitens sie in unmittelbarer geographischer Nähe zueinander liegen (die maximale Entfernung von einem Zentrum zum anderen beträgt ca. 50 km) und drittens sie durch nationale und politische Grenzen getrennt sind und damit a priori das Vorhandensein institutioneller Unterschiede signalisieren, versprach dieses Untersuchungsgebiet gewinnbringende Ergebnisse zu Tage zu fördern. Diesen drei Städten konnten wiederum drei kleinere, benachbarte Untersuchungseinheiten zugeordnet werden, die ausreichend ökonomische und demografische Mikrodaten für die Untersuchungseinheiten boten: diese Untersuchungseinheiten waren die Gemeinden Würselen (Deutschland), Meerssen (die Niederlande) und Sart lez Spa (Belgien).

In Kapitel II wurde zuerst ein Überblick über die grundsätzlichsten, in der Studie verwendeten Konzepte gegeben. Institutionen, Lebensstandards und Grenzen spielten hierbei eine wichtige Rolle. Darauf folgte die Präsentation der für die vorliegende Arbeit relevanten, großen theoretischen Leitlinien der historischen Demografie. Dem Leser konnten hier die Grundlagen der Malthusianischen Bevölkerungswachstumsbegrenzungslehre präsentiert werden. Diese Lehre Malthuses besagt, dass vorindustrielle Gesellschaften entweder zyklisch mit hohen, ungeplanten Ausschlägen in der Sterblichkeit (positive check) oder stetig mit vergleichsweise geringen Ausschlägen in einem selbst geplanten Heirats- und Geburtenverhalten (preventive check) wachsen. Diese präventive, endogene und von den Familien selbst betriebene Wachstumskontrolle sollte im Verlauf der Arbeit im Fokus stehen. Vor allem galt das Interesse hierbei dem Heiratsverhalten als Hauptmechanismus dieser Kontrolle im vorindustriellen und sich industrialisierenden Europa (Szreter and Garrett 2000, p. 52). Dementsprechend wurde im Theorieteil vertieft auf die Theorien des Europäischen Heiratsmusters von John Hajnal (Hajnal 1965) eingegangen, das dem Teil Europas, in dem sich auch das Dreiländereck Belgien, die Niederlande und Deutschland befindet, ein besonderes Heiratsverhalten attestiert. Dieses ist laut Hajnal hauptsächlich durch späte Heirat, geringe Altersunterschiede der Partner und neolokale Familiengründung gekennzeichnet (ibid.). Während einige Forscher nun in diesem speziellen Heiratsverhalten wiederum Gründe für das frühe Wirtschaftswachstum Europas und den höheren Lebensstandards des Westens sehen (de Moor and van Zanden 2010), richten sich andere diesbezügliche Erklärungen eher auf den institutionellen Rahmen in den eine Gesellschaft eingebettet ist (Dennison and Ogilvie 2013; Edwards and Ogilvie 2018).

In jedem Fall bildete diese Debatte die Basis zur Entwicklung der Hypothesen, die es im Verlauf der Arbeit zu testen galt, um dann wiederum aus diesen Ergebnissen heraus die oben genannte

Forschungsfrage zu beantworten. Für das Erreichen dieses Ziels wurde ein analytischer Rahmen erarbeitet, der zum einen festlegte, was wirtschaftlicher Druck für Individuen und junge Paare in ihren Gemeinden bedeutet, und zum anderen mögliche Strategien des Durchkommens durch wirtschaftlich schlechte Phasen darstellte. Diese Strategien, das sind Sparen, Borgen, das Erhalten von Armenfürsorge, das Anpassen der Nachfrage von Arbeitskraft und schließlich das Verzögern von Heiraten, konnten dann mit solchen Institutionen verknüpft werden, die eben diese Strategien beeinflussen: Erb- und Eigentumsrechte, Sparkassen, Kreditinstitute, Armenfürsorgeeinrichtungen, moderne Sozialgesetzgebung, Arbeitsmarktstruktur und schließlich die `super´ Institution Familienorganisation und –bande, die die meisten der eben genannten formellen Institutionen auf informeller Ebene stark beeinflusst.

Auf den Theorieteil folgte in Kapitel III der Teil der Arbeit, in dem die methodische Vorgehensweise, die sich als beste zur Beantwortung der oben genannten Forschungsfrage herausgestellt hatte, vorgestellt wurde. Es wurde zum einen dargestellt, wie der historische Kontext des Dreiländerecks sowie der der drei Gemeinden rekonstruiert werden sollte, zum anderen wie wirtschaftlicher Druck und die demografischen Reaktion auf diesen gemessen werden können. Die Mischung aus qualitativer und quantitativer Forschung mittels Literatur- und Archivrecherche für ersteren und statistischer Analysen für den zweiten Teil erwies sich hierzu als die ertragreichste. Die für die Analyse verwendeten Daten sind dementsprechend ebenfalls in zwei Kategorien einzuteilen, erstens in Primär- und Sekundärquellen aus Literatur und/ oder lokalen Archiven und zweitens in digitalisierte Preiszeitreihen und genealogische Längsschnittdaten aus der Region bzw. direkt aus den untersuchten Gemeinden. Die Auswahl der Daten wurde präsentiert und logisch begründet, die Qualität der Daten evaluiert und kritisch diskutiert.

In diesem Abschnitt der Arbeit wurde der Leser ebenfalls an die statistischen Modellierungsverfahren, die in der Untersuchung Anwendung fanden, schrittweise herangeführt. Das Konzept der historischen Ereigniszeitanalyse unter der Anwendung von fachspezifischen `Cox Regressionen´, das später die Grundlage der statistischen Modelle zur Messung von wirtschaftlichem Druck und demografischen Reaktionen bilden sollte, stand hierbei im Mittelpunkt.

Kapitel IV diente in einem ersten Teil hauptsächlich der qualitativen Rekonstruktion der historischen Wirklichkeit des Dreiländerecks Belgien, Niederlande und Deutschland unter denen die Gesellschaften Würselens, Meerssens und Sarts im Verlauf des 19. Jahrhunderts lebten.

Hierbei war es wichtig die großen äußeren politischen Umwälzungen zu skizzieren. Das waren vor allem die politischen Veränderungen nach der endgültigen Niederlage Napoleons und die durch die Industrialisierung initiierten wirtschaftlichen und gesellschaftlichen Umbrüche. Für die weitere Analyse mindestens ebenso wichtig war jedoch auch die Darstellung der historischen Gegebenheiten und Entwicklungen der drei Kommunen aus einer eher mikrogeschichtlichen Perspektive heraus, die ebenfalls in diesem Kapitel realisiert werden konnte.

Der zweite Teil des Kapitels diente dazu die Institutionen zu rekonstruieren, die Einfluss auf Unterschiede im demografischen Verhalten von Individuen und jungen Paaren unter wirtschaftlichem Druck haben oder haben könnten. Das sind einerseits solche formellen Institutionen, die das Sparen oder die Aufnahme von Krediten ermöglichen (z.B. Sparkassen), die durch kommunale oder staatliche Armenfürsorge und/ oder moderne Sozialgesetze ein bestimmtes Mindestmaß an Lebensstandard generieren und solche, die den Arbeitsmarkt regulieren und somit Einfluss auf Arbeitsbedingungen und Migration nehmen. Andererseits sind das auch informelle Institutionen, z.B. die familienintern geregelte Erbfolge, Geschenke, informelle Geld- oder Sachleistungen, die es Paaren leichter machen, ihre Familienplanung umzusetzen. Während formelle Institution entweder durch Literaturrecherche oder Archivarbeit relativ einfach zu rekonstruieren waren, fast immer gibt es zu Gesetzen aus dem 19. Jahrhundert einschlägiges Quellenmaterial, mussten die informellen Institutionen in der oben bereits angesprochenen `super´ Institution Familienorganisation und -bande zusammengefasst werden. Durch die Approximation dieser informellen Institution durch speziell designte Variablen in den später verwendeten statistischen Modellen war es jedoch möglich statistisch signifikante und interpretierbare Ergebnisse zu generieren. Der vergleichende Ansatz des Kapitels vermochte zudem bereits im Vorfeld der Hauptanalyse zu zeigen, dass Eigentumsrechte und das geltende Erbrecht in der Beantwortung der oben gestellten Forschungsfrage nur eine untergeordnete Rolle spielen können.

Kapitel V stellt das Kapitel der Hauptanalyse dar. In diesem vor allem quantitativen Teil der Arbeit wurden zuerst für jede der drei Kommunen deren übliche Heiratsmuster bestimmt. Diese Heiratsmuster konnten klar dem Europäischen Heiratsmuster im Sinne Hajnals zugeordnet werden. Im Teil der darauf folgenden induktiven statistischen Analysen wurden dann insgesamt elf vergleichbare Regressions-Modelle aus den zuvor rekonstruierten historischen Realitäten und Institutionen entwickelt, die den jeweiligen Dörfern zugeordnet und schließlich in drei bzw. zwei verschiedene Perioden des Jahrhunderts unterteilt werden konnten. Auf dieser Grundlage konnten

dann sowohl das Heiratsverhalten als auch der Einfluss der zuvor erarbeiteten Institutionen auf dieses Heiratsverhalten unter wirtschaftlichem Druck analysiert werden. Durch die Analysen konnten viele Ergebnisse gesammelt werden, die es wiederum ermöglichten die eingangs gestellte Forschungsfrage nach den institutionellen Auslösern der Entstehung von Heterogenität in der demografischen Entscheidungsfindung von Individuen und Paaren unter wirtschaftlichem Druck zu Beginn der industriellen Revolution zu beantworten:

Die Studie ergab, dass die günstigste Situation die Malthusianischen Gesetze frühzeitig zu überwinden eine Situation war, in der es Individuen und Paaren ermöglicht worden war eine "Mischung verschiedener Strategien" (Kok 2002) zur Überwindung von wirtschaftlichem Druck anzuwenden. Das Zusammenspiel von formellen und informellen Institutionen, die zum einen Chancen für ausreichenden Bargeldfluss („Bargeld Jonglieren"; Deneweth et al. 2014, S. 89) bieten, und Institutionen, die zum anderen (finanzielle) Belastungen durch Transfers durch die Gesellschaft abfederten (Laslett 1983; Reher 1998), gaben Einzelpersonen und jungen Paaren die Möglichkeit äußeren wirtschaftlichen Druck selbst und durch eigenes Handeln zu überwinden. Je mehr Bargeldfluss-sichernde Institutionen zur Verfügung standen, z.B. Pfandhäuser, Sparkassen, Möglichkeiten zu Zuverdiensten als Dienstknecht oder –magd, funktionierende Kredit- und Landmärkte innerhalb der Familie (Fertig 2003b, p. 226), und je mehr das Verschwinden starker familiärer Bindungen zunahm, das wiederum den Individuen und Paaren das Nutzen der formellen Einrichtungen im höheren Maße erlaubte, umso besser konnten sich die jungen Familien an die bevorstehende und sich beschleunigende Industrialisierung anpassen. Die Hilfe einer größeren, autoritären und stark hierarchisch organisierten Familie wurde immer weniger benötigt. Tatsächlich ermöglichte die Schwächung der familiären Bindungen eine verminderte (gefühlte) Verpflichtung, ältere und kranke Familienangehörige selbst zu pflegen. Stattdessen wurde diese Pflege stärker an öffentliche oder private Organisationen ausgelagert. Die schwächeren Familienbindungen erlaubten aber auf der anderen Seite auch den Eltern ihr Schicksal nach dem Arbeitsleben vermehrt selbst in die Hand zu nehmen (vgl. Bouman et al. 2012, S. 21f) und weniger von ihren Kindern abhängig zu sein. Die Sozialversicherung als eigenständige Institution blieb dabei freilich eine wünschenswerte Unterstützung. Sie gab den Menschen die Chance wirtschaftlich schlechte Zeiten zu überwinden ohne völlig von der Gesellschaft ausgeschlossen zu werden. Die Verbesserung der Armenfürsorge und das Entstehen moderner sozialer Sicherheitsgesetze sind insgesamt jedoch wesentlich bedeutsamer für die Möglichkeit "mit etwas

Hilfe zu überleben" (van Leeuwen 1993), und damit die Sterblichkeit zu senken, als dafür junge Paare mit den (finanziellen) Kosten der Heirat zu entlasten.

Aus der Analyse hervorgehend kann abschließend festgestellt werden, dass es sich um eine Mischung aus diesen formellen und informellen Institutionen handelt, die den Rahmen für ein demographisches Verhalten bildet, das seine Agierenden in die Lage versetzt Heiraten geplant zu verzögern. Diese möglich gemachte geplante Verzögern der Heiraten wiederum, schützt junge Paare dieses demografischen Regimes vor äußerem wirtschaftlichen Druck besser als solche, denen das aufgrund fehlender oder zu stark eingreifender Institutionen nicht realisierbar ist. Anders als von Edwards und Ogilvie (Edwards und Ogilvie 2018, S. 7) postuliert, konnte und kann das Europäische Heiratsmuster (Hajnal 1965) tatsächlich wesentlich zum Wirtschaftswachstum beitragen, wenn der institutionelle Rahmen die Nutzung der dazugehörigen Vorteile zulässt. Das Europäische Heiratsmuster und der ihm innewohnende Familienlebenszyklus erlauben die zyklische Anhäufung von Kapital, die am Lebensende häufig das Eigentum eines bestimmten Vermögens zur Folge hat. Dementsprechend können der frühe wirtschaftliche Aufschwung des Westens und seine anhaltende Rolle als wirtschaftlicher Anführer und Inhaber der weltweit höchsten Lebensstandards nur unter Einbeziehung des spezifischen europäischen Heiratsmusters zufriedenstellend erörtert und erklärt werden.

Die Studie "Coping and Caring: Institutions, Transition, and Families under Economic Pressure" versteht sich als Beitrag zur Debatte um das Europäische Heiratsmuster und Institutionen als Generator für den wirtschaftlichen Aufstieg des Westens. Sie konnte zeigen, dass das Messen von Einflüssen von Institutionen auf demografisches Verhalten möglich ist und wie es gelingen kann. Um die Debatte weiter in diese Richtung fortzuführen wäre es wünschenswert, dass sich zukünftige Studien detaillierter mit den aus dieser Studie herausgearbeiteten Institutionen und deren Wirkung auf das demografische Verhalten von Individuen und jungen Paaren befassen. Aber auch die Untersuchung von Institutionen, die nicht im Rahmen dieser Arbeit evaluiert werden konnten, so z.B. religiöse Erziehung (Kok 2017) oder nationale `Kultur´ im Sinne Hofstedes (Hofstede 1997[1991]), stellt ein vielversprechendes, in die hier eingeschlagene Richtung weiter zielführendes Desiderat dar.