The Roots of Europe's Population

Demography, workforce, and family in early medieval Provence (AD 813-814)

This paper aims at furthering our understanding of early medieval population dynamics and family formation. To this end, we conduct an analytical study of a particularly ancient source: the polyptych of the Abbey of Saint Victor in Marseille, in the Provence region of Southern France, compiled between AD 813 and 814. While the polyptych's information is limited in time and space, it is one of the very few written sources that offers quantifiable data allowing to infer demographic patterns and structures of the early medieval period.

Little is known about early medieval European population trends. While general estimates have been proposed (McEvedy and Jones 1978), there is almost no information on age structure, mortality, fertility, or marriage regimes. Paleodemographic analyses have recently provided interesting results on mortality and the life standards of medieval populations in Italy and different areas of Europe (Barbiera and Dalla Zuanna 2009; Barbiera et al. 2018; Steckel et al. 2019), yet this type of data does not shed light on marriage systems or fertility trends. The source considered in this paper, together with the methods of analysis employed, allow for the first time to draw several hypotheses on age structure, marriage, and fertility, and to reflect on the role played by mobility. Although the polyptych of the Abbey of Saint Victor in Marseille offers a picture of the early medieval population specific to Provence, it can also be compared to other late medieval populations, thus increasing our knowledge of European population dynamics before the spread of cadastres and parish registers.

Polyptychs are land and workforce inventories that were compiled by owners as a means to control their properties. Of the dozen polyptychs that have been preserved, dating from the 9th to the 10th century AD, only four record, in addition to the properties, the workforce employed. These four were all complied by monasteries and include the polyptychs of Saint-Victor de Marseille (compiled between AD 813 and 814), Saint-Germain-des-Prés in Paris (AD 829), St Remi de Reims (compiled after AD 848), and that of the Abbey of Farfa, recording its properties in the Abruzzi region in Italy (compiled in about AD 829). The names attributed to these polyptychs are somewhat misleading, in that the documents actually consist of lists of assets and families that were not concentrated in the monastery area itself, but were rather distributed over very large and disperse areas, which had varied relations of economic dependence on the monastery.

Neither were there any shared rules in the compilation of such documents. In the polyptych of Farfa, kinship ties between individuals are accurately described, allowing for a fairly detailed analysis of the household structures of the employed workforce (Ring 1979, Feller 1994). In the polyptych of Saint Victor of Marseilles, the ages of the children are specified, facilitating the reconstruction of the age structure of the population, as we shall see below. As underlined by Devroey (1981), each document has its own specificities and necessitates a detailed analysis that takes into account both the compilation system and the landowners' point of view.

We focus here on the polyptych of Saint Victor of Marseilles, as the type of data reported for farms and employees allows to conduct an in-depth study of several demographic aspects, as well as of the organization of farms in relation to the territory. This document is also unique in that the ages of children and the number of adolescents were recorded with precision. There are, however, several challenges to working with this source. One of the most important issues is that the registered population is made of up those individuals employed on the lands owned by the Abbey, which were scattered across a relatively large area of Provence. It does not therefore represent a

homogeneously distributed population in a well-defined territory. A first task thus consists of assessing whether or not the registered population is selected.

Work to date on the polyptych of Saint-Victor in Marseille has aimed to precisely locate the farms and has developed several hypotheses on population dynamics in the area. There is an absence, however, of more detailed demographical analyses, with the exception of the study carried out by Zerner-Chardavoine (1981) that considers only the children listed in the document. We investigate this polyptych in more detail from a demographic and social perspective, focusing on the listed population and the ways that farms were organized.

Before turning specifically to the source, we provide background on the demographic situation of Europe and Southern France during the Early Middle Ages.

1. Population decline and resurgence in Southern France

Estimated early medieval European population trends suggest that a first demographic decline took place during the economic crises of the 3rd century. A second critical period occurred at the beginning of the Early Medieval Period, in concomitance with the fall of the Roman Empire, barbarian migrations, and then the Justinian Plague of the mid-6th century (Biraben and Le Goff 1975, Biraben 1987, Little 2008, Green 2014). A slow recovery likely began at the end of the 9th century, accelerating starting in the 11th century (McEvedy and Jones 1978). Studies of the French population show similarities to these cycles of recovery and decline, although differences have also been highlighted. More specifically, an estimated population of 5.8 million during the first century AD most probably decreased during the 3rd and 4th centuries due to economic crises (McEvedy and Jones 1978, Etienne 1988). Such declining trends would have persisted until the 5th century and then worsened beginning in the mid-6th century. Indeed, from this time on the Justinian Plague, first documented in written sources[1] in 543 in Southern France and the area of Lyon, provoked a new phase of demographic decline. The end of the plague in the mid-7th century, followed by political stability brought on by the reign of Charlemagne, saw a period of economic stability and demographic growth. The so-called Carolingian Renaissance brought not only a flourishing of culture but also stability and the growth of estates, particularly those owned by ecclesiastical institutions such as monasteries (Bautier, 1988).

This broad picture was marked by local and regional variance, although relative little is known to this regard given the dearth of available information for the time preceding the spread of parochial registers beginning in the late-16th century. There is, however, general scholarly consensus that the South and the North of Gallia (name given by the Romans to present-day France) experienced quite different political and economic trends. In southern Gallia, the end of the Roman empire was less dramatic than elsewhere, as here continuity with the Roman system was stronger than in other regions of Europe: Roman senatorial aristocracy maintained its power, large-scale land properties persisted, and taxes were likely still collected during the 7th century (Wickham 2005, Halsall 2007). This area then became more unstable beginning in the 8th century due to tensions with the Muslims in Spain and then the Saracen attacks starting in the 9th century (Bautier, 1988). Northern Gallia experienced different trends as this area was less stable after the Roman Empire came to end, although according to several scholars, faint signs of recovery are visible in some places beginning in the 6th century, such as in the Picardy region, where new

[1] Written sources document the spread of the Justinian Plague in Mediterranean areas, particularly those touched by trade, although recent genetic analyses have also shown its presence in Upper Bavaria, in the cemetery of Aschheim, where according to ancient sources it had not spread (Wiechmann and Grupe 2005).

settlements were founded in this period (Bautier, 1988; Halsall 2007). A time of stability followed, only to be disrupted during the 8th century by Norman attacks.

Further insight into population trends for this region are also offered by paleodemographic analyses. In a previous study of ten necropolises in Southern France between the 1st and 11th centuries, we estimate an indicator **d**, or the ratio between deaths at ages 5-19 and those at age 5+. Merging all the necropolises, this indicator is 0.20 (Barbiera et al. 2017). We show that this value — not very different from those found in other European areas during the first millennium AD — corresponds to a life expectancy of around 20 years of age. For this reason, for the population of the polyptych under examination, we also begin from this mortality estimate (Barbiera and Dalla Zuanna 2009; Barbiera et al. 2018), corresponding to the first level of South Europe high mortality model life table (Woods 2007).[2]

2. The farms and territory of Saint Victor of Marseille

The polyptych of the Abbey of Saint Victor of Marseilles was drafted in the years AD 813-814 and 835, under the authority of the Abbot Wadalde (for this reason, in the French literature this document is often referred to as the *Polyptyque de Wadalde*). The document bears the title of *descriptio maniciporum*, or literally "inventory of slaves," yet scholars agree that the term *mancipum* should be understood in the sense of employee in a generic sense (Rio, 2017).

Several hypotheses have been formulated as to the purpose of the document. According to Nicolas Carrier (2012), the registration was intended to reorganize the workforce and relocate the future population. This would explain the accuracy in recording the ages of children and the number of adolescents, or those individuals who would one day work the lands of Saint-Victor. Another hypothesis suggests that the polyptych was drafted to define land property rights (Rio, 2017).

The document lists 272 farms (identified mostly by the term *colonica*), located in 14 districts in Provence, covering both low lands as well as highlands in the Alps. Among these, 127 are defined as *apste*, or empty (the late Latin term is *apsta* in the singular and *apste* in the plural), which has sparked much debate among scholars. According to Weinberger (1973), for example, the high proportion of empty farms is a sign of demographic decline. Yet Zerner-Chardavoine (1981), on the basis of her analyses of children, suggests that the registered families experienced a period of demographic recovery. Alternatively, since 16 of the farms registered as *apste* were actually inhabited by single individuals or one or more families, the term may have been used to define those farms from which the Abbey could not collect the fees due, as hypothesized by Rosamond Faith (2010). This does not, however, explain why, for the great majority of the farms registered as *apste*, dwellers were not registered. Indeed, one might expect special attention to be paid to workers on farms from which payments were expected but not received. That some farms listed as *apsta* were in fact populated seems to suggest that an operation of workforce reorganization was in progress (Carrier 2012; Zerner-Chardavoine 1981). Moreover, in 23 of the empty farms

[2] Woods proposes some standard life tables for Southern Europe based on different mortality indicators deduced from the analysis of populations ranging from the times of Ancient Greece to the beginning of the twentieth century. Compared to the more well-known and used tables of Coale & Demeny (1983), those proposed by Woods have the advantage of not being the result of extrapolation for higher mortality levels (e_0<30). Compared to the tables of Coale & Demeny West, level 1 (e_0 = 19), the Woods tables with the highest mortality (e_0 = 20) are characterized by a higher mortality at age 0-4 (+ 22%), lower at ages 5-50 (-18%) and higher at age 50-69 (+ 14%). The results of the comparison do not substantially change if instead of the Coale & Demeny standard tables West we consider those of the South family.

without dwellers, the document compilers added the words *pasco* (in 2 cases) or *pasco verbecem* (21 cases), possibly indicating that these lands were used as pasture, mainly for sheep (*verbecem*) and perhaps seasonally.

Thanks to previous work (Sauze 1984; Devroey 2004; Faith 2010; Renard 2012) it is possible to geo-localize 177 farms (88 in the plains/hills, 89 in the mountains, located at least 600 meters above sea level). Among the farms in the plains/hills, 61% are empty (defined as *apste* and without dwellers), while among those located in the Alps only 27% are empty, suggesting a higher concentration of the farm workforce in the highlands. Recall, however, that the farms listed in the document are only those owned by the Abbey, with the individuals listed being those settled on these farms, thus the high percentage of depopulated farms in the plains/hills may simply reflect the specific dynamics of the Abbey's properties and not all the farms in the area. We can, however, observe that the most populated properties of Saint Victor were located in the highlands.

Most of the farms are described as *colonica,* generally indicating a farm, although 20 are defined as *vercarias*, suggesting that they were probably primarily devoted to sheep or goat rearing. The latter were all located in the highlands and 5 were uninhabited. Various scholars believe, however, that all farms had a mix economy, based on the raising of sheep and pigs and the cultivation of cereals (Faith 2010). This hypothesis is also supported by the types of fees due to the monastery annotated in the document. Although only sporadically recorded and thus not usable for a detailed study of the extension and economy of all the farms (for instance, fees in money are annotated for only a few *vercarias*), they nonetheless indicate that peasants owed the monastery taxes in money or in goods such as: chickens, eggs, pigs, sheep, and more generally meals.

3. Population structure and dynamic

We now consider in further detail how the population living in such environments was structured. Starting from the data on sex, age, and family relationship reported on the polyptych, we first estimate the population amount and its structure by sex and age. Secondly, we compare the age structure with that of other European populations of the Middle Ages or Modern times, for which it is reasonable to suppose sufficiently complete data collection for individuals of all ages. Then, working with the structure data, we estimate the birth rate of the population listed in the polyptych, comparing it to that detected or estimated for other populations. Finally, we evaluate the demographic regime of the Marseilles polyptych by comparing it with some model-populations.

3.1. Estimating the population by age and sex

There are 935 individuals listed in the document, for each of which their name (thus sex), marital status, and kinship relations (*uxor* [wife], *maritus* [husband], *filius* [son], *filia* [daughter]) are recorded. For most of the children age is also registered, most frequently between the ages of 3 and 10. Only a few children are reported as having 1 or 2 years of age, while a high number are listed as sucklings (*infans ad uber*). There is a very low number of children recorded as being between the ages of 10 and 15. A separate group of individuals, boys and girls, are defined as *baccalarius* (plural: *baccalarii)* and *baccalaria* (plural: *baccalariae*). Scholars agree that this term was the precursor of the word "bachelor," and indicates young unmarried individuals (Zerner-Chardavoine 1981; Feith, 2010). This hypothesis is supported by the fact that in the document,

only two of the 129 male *baccalari* had a wife, while among the 122 female *baccariae*, only 1 was married and 4 had children. Thus, we conclude that *baccalari* and *baccalariae* were young individuals, for the most part unmarried. There is also a group of children whose age is not defined and who are recorded as being at school (*ad scola*). Generally, we observe an age heaping around ages 5 and 10 (see Table 1). The ages of the adults are not recorded.

Table 1: Ages of children and adolescents precisely registered (*)

	Description of child ages				Children by age													Adolescents	
Sex	***Infans ad uber***	***Infante***	***Ad schola***	**Age non readable**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**15**	***Baccalaria***	***Baccalarius***
Males		*7*	*8*	*2*		*1*	*7*	*7*	*7*	*3*	*4*	*11*	*2*	*9*	*1*	*1*	*1*		*129*
Females		*3*	*4*		*1*	*3*	*7*	*5*	*21*	*10*	*6*	*4*	*5*	*10*	*1*		*2*	*122*	
Undefined	*30*	*2*					*2*	*1*	*5*	*2*				*1*					
Total	*30*	*12*	*12*	*2*	*1*	*4*	*16*	*13*	*33*	*15*	*10*	*15*	*7*	*20*	*2*	*1*	*3*	*122*	*129*

(*) In the tables of this article, we report absolute values (directly calculated by the polyptych or estimated) in italics, while other numbers (proportions, demographic indicators, etc.) are in normal type.

There are, moreover, individuals described as children but whose number is not reported. For instance, in *Villa Betorrida*, *Colonica in Curia* a man named *Saumo*, *cum infantes suos* (with his children) is listed, or in *Agro Galadio, in Vercaria in Nannas*, Maria and her husband are listed *cum infantes suos* (with their children). There are in total 59 family units for which children are generally listed with notations such as: *infantes suos, cum infantes suos, filii eorum, filios suos* (all meaning: with their children). Although "children" is always plural, it may have been standard form to indicate "with children" even where there was just one child, as in modern Romanic languages. We estimate the number of children in these family units, distributing them following the proportion of units with known numbers of children, as illustrated in Table 2.

This estimation results in a total of 206 additional individuals. We define them as children when described in the polyptych as *infantes* (199 individuals), and as adults (5) and youth (2) when described as *filii*. Thus, the total population living in the lands of the Abbey listed in the polyptych amounts to an estimated population of 1,141 individuals.

Table 2: Estimate of children in family units with an indefinite number of children

Number of children	**Number of units with known number of children**	**Proportion of units with known number of children**	**Breakdown by number of children of the units with indefinite number of children**	**Our estimation of *filii sui***
(a)	(b)	(c)=(b)/131	(d)=(c)x59	(e)=(d)x(a)*
1	*20*	0.15	*9.01*	*9*
2	*29*	0.22	*13.06*	*26*
3	*23*	0.18	*10.36*	*31*
4	*21*	0.16	*9.46*	*38*
5	*19*	0.15	*8.56*	*43*
6	*9*	0.07	*4.05*	*24*
7	*5*	0.04	*2.25*	*16*
8	*3*	0.02	*1.35*	*11*
9	*2*	0.02	*0.90*	*8*
Total	*131*	1.00	*59.00*	*206*

*The values have been rounded

Using this data we can easily reconstruct the structure of the population by age-group and sex. As Table 3 shows, the general sex ratio (SR) of the total population is balanced, suggesting that

there is neither an over- nor under-estimation by sex. More specifically, for the group of *baccalari* and *baccalariae* the balanced sex ratio suggests that this age class referred to the same age span for males and females. The sex ratio of adults is, for the most part, also balanced. In the document there are 37 husbands and 25 wives who are defined as *extraneus/a,* or foreigners. If we detract these individuals from the group of adult males and females, we obtain a completely balanced sex ratio of 1.04. Differently, the SR of children is slightly unbalanced towards females. This result is interesting in that it paints a very different picture than that observed in Italy during the same period, where medieval written and archaeological sources report a constant distorted sex ratio toward males from the 6th until the 15th century AD, interpreted as the result of higher mortality of young females (Barbiera 2012; Barbiera et al. 2017; Ring 1979; Herlihy, Klapisch-Zuber 1988). More generally, the sex ratio obtained from the polyptych considered here is in line with medieval archaeological data from France (Barbiera et al. 2017), which displays a balanced sex ratio. The lack of male children can perhaps be explained by the fact that some of these children were away from home attending school (presumably in a monastery) and may have been left out of the registration. In fact, among the children defined as *ad schola*, 8 were males and only 4 females, indicating that boys were sent to school more often than girls.

Given the age heaping observed around the age of 10, we assume that the ages of children could be defined between 0 and 12.5 years. Adolescence would thus start at age 12.5, including all individuals defined as *baccalarius, baccalaria* and those few individuals described as having 13, 14, and 15 years of age. Given the balanced sex ratio for *baccalarii* and *baccalariae*, we expect that this class ended at the same age for males and females. As almost all the *baccalariae* have no children, we fix the threshold for adulthood for both men and women at 22.5 years of age (see below for several considerations on age at first marriage). If this threshold were to be slightly lower or higher (for example 20 or 25 years of age), the picture would not change substantially, as we shall see shortly. The remaining individuals are classified as adults.

Table 3: Population structure in the polyptych

	Children 0-12.5	Youth 12.5-22.5	Adults 22.5-z	Total
Males	*70*	*130*	*254*	*454*
Females	*80*	*124*	*234*	*438*
Sex Ratio M/F	0.88	1.05	1.09	1.04
Sex unknown	*43*	*0*	*0*	*43*
Estimated	*199*	*2*	*5*	*206*
Total	*392*	*256*	*493*	*1,141*
Total (row %)	35	22	43	100

3.2. Comparing age structures

We compare the age structure of the polyptych of Marseille with those of several populations intensively studied by other scholars and characterized by a good level of completeness and quality of data collection, even for children and accounting for different demographic parameters. More specifically, we consider four comparable populations (Table 4): the city and countryside of Legnago (south of Verona, Italy) in the Cadastre of 1420 (Dalla-Zuanna et al. 2012), Tuscany in the Cadastre of 1427 (Herlihy and Klapisch-Zuber 1988, the Italian version as it contains detailed tables on the population structure, missing in the English version), England of 1696 (Wrigley and Schofield 1989), and France of 1740 (Henry and Blayo 1975). In Legnago – as far as we know – the last outbreak of plague occurred prior enough to not influence the age structure (Rossi 2013).

Table 4: Population age structures and some demographic parameters in five medieval and modern populations

	Population structure Row %			Birth		Mean age at first marriage	e_0
	0-12.5	12.5-22.5	22.5-z	b ‰	TFR	for women	
Saint Victor (813)	35	22	43	52[a]	---	---	(20)[b]
Legnago (1420)[c]	37	21	42	55[a]	7.5	21	(20)[b]
Tuscany (1427)[d]	32	15	53	47[a]	---	18[e]	(20)[b]
England (1696)[f]	27	17	56	32	4.5	26	34.1
France (1740)[g]	28	18	54	40[h]	5.5[h]	26[i]	24.7[j]

[a] Our estimation with formula [1] – see part 3.3.
[b] Our hypothesis, see part 3.4.
[c] Dalla-Zuanna et al. 2012.
[d] Herlihy and Klapisch-Zuber 1988, Appendix 5, Table 1 (our calculations).
[e] Herlihy and Klapisch-Zuber 1988, p. 540.
[f] Wrigley and Schofield 1989.
[g] Henry and Blayo 1975.
[h] Vallin 2006, p.50
[i] Henry and Houdaille 1979.
[j] Vallin 1989

The population age structure of the Marseilles polyptych is practically the same as that of the Legnago Cadastre of 1420, and not very different from the Tuscan Cadastre of 1427. The age structures of England in 1696 and France in 1740 are different, characterized by a smaller proportion of children and a greater proportion of adults. Interestingly, however, in the reconstruction of the population of England, based on the Domsday Book of 1086, the authors estimate that the proportion of children aged 0-14 was 37.5%, quite close to our own estimates (Harvey 1988).

All of the populations compared here were not, at the time, experiencing a post-plague recovery, when the proportion of the population age 0-12.5 could well exceed 40% (Herlihy and Klapisch-Zuber 1988, 503-521). Consequently, the differences and similarities of the age structures should be due – essentially – to "normal" demographic dynamics, according to the modalities discussed in the following sections.

3.3. Estimating the birth rate

Starting from data in Table 3, we estimate the birth rate **b** for the population of the polyptych, using the own-children logic for estimating fertility based on the age structure (Grabill and Cho 1965). The births that occurred each year over the previous 12.5 years are:

$$\text{Annual births} = \text{Population}_{0\text{-}12.5} \times (12.5 l_0 / L_{0\text{-}12.5}) / 12.5 = \text{Population}_{0\text{-}12.5} \times l_0 / L_{0\text{-}12.5} \quad [1]$$

Suppose that mortality at age 0-12.5 is close to the one of standard life table of Woods, with $\mathbf{e_0}$=20. Note that this choice is supported by previous paleodemographic research on this period, where we show that populations in Southern France were quite close to this mortality regime (see also the final paragraph of Section 1). For the population of the polyptych, we obtain the following estimate of the birth rate: **b** = 0.35 x 0.148 = 0.052 = 52‰.

Applying the same procedure, using the same level of mortality, the birth rate was 55‰ in Legnago in 1420 and 52‰ in Tuscany in 1427. While these estimations may seem raw, when applying the formula [1] for England 1696 (Woods standard table with e_0=35) and for France 1740 (Woods standard table with e_0=25), we obtain **b**=0.27x0.12=32‰ for England and **b**=0.28x0.14=39‰ for France, i.e. the same values of **b** obtained using other data and following entirely different procedures (see Table 4).

For Legnago – using the classic own-children method – the totally fertility rate (TFR) for the five years before the Cadastre was estimated at around 7.5, whereas the singulate mean age at first marriage (SMAM) for females was 21 (Dalla-Zuanna et al. 2012). Although we cannot be sure that the population of the polyptych follows the same marital and fertility regime of Legnago, its age structure – which is practically the same – is compatible with the fertility and the age at first marriage of women of Legnago. This result also supports as being reasonable the age threshold of 22.5 for distinguishing between *baccalariae* and adults.

3.4. Comparing the polyptych with stable populations

We also compare the polyptych with the stationary populations associated to some standard life-table proposed by Woods for Ancient Southern Europeat different levels of mortality (Table 5).

The population age structure of the polyptych resembles that of Woods with $\mathbf{e_0}$=20. On the contrary, if mortality had been lower, the age structure of the stationary population would have been older than that of the Marseilles polyptych.

Table 5: Population structure (column %) of polyptych and of stationary populations associated to some Woods standard life table

Age groups	Ages	St. Victor Polyptych	Woods standard life-table – e_0 level		
			20	**30**	**40**
Children	**0-12,5**	**35**	35	33	31
Juvenies	**12,5-22,5**	**22**	22	21	20
Adults	**22,5+**	**43**	43	46	49
Total		**100**	**100**	**100**	**100**

These striking similarities between the age structure of the polyptych and other medieval land registers with that of the stationary population associated with the standard Woods table suggest that – indeed – for those populations mortality should have been closer to e_0=20 than to e_0=30. Alternatively, mortality could have been lower, but there should have been consistent and continuative emigration flows of adults and children. The Marseilles polyptych gives us little information on migrations, but those few suggest that there were both inflows (evidenced – as we shall see – by a certain number of spouses registered as "strangers") and outflows (evidenced by farms registered as "empty"). In any case, it is difficult to think for the rural Carolingian Southern France, of migratory flows of a continuity and a force that would upset the shape of the age structure determined by natural demography.[3]

In conclusion, several clues agree in suggesting that the population of the Marseilles polyptych was at high demographic pressure, with mortality at age 0-4 close to 50%, e_0 around 20 years, birth rate around 50‰, and consequently with at least seven children per woman. This demographic regime is quite different from that found in England at the end of the seventeenth century and in the France of the beginning of the eighteenth century, more similar to that observed in other European medieval communities.

4. Marriage and remarriage

[3] McEveday and Jones (1979) suggested a growth rate of +0.5‰ for France in the period between the 9th and 10th centuries (see also Bautier 1988).

Nuclear kinship ties are specified within the various farms listed in the polyptych: wives, husbands, and children are clearly registered, as are a certain number of widows (but not even one widower), ecclesiastical males (7 *presbiter*, 3 *diaconi*, and 6 *clerici*), and individuals with children but who do not appear to have a spouse. This information allows to distinguish between married (having a wife or a husband recorded in the document) and unmarried individuals (widows and those without a recorded spouse, excluding ecclesiastical males), as well as between individuals with and without children (we did not include the 5 estimated adults registered as *filii sui*, for whom we have no information on civil status, see Table 6). When considering adults without children (Table 6), the proportion of unmarried individuals is higher among men than among women, respectively 69% and 59%, suggesting that men married later than women. When observing adults with children, the proportion of unmarried men (16%) is lower than that of unmarried women (25%), indicating that women remained widows in higher proportion than men, partly due to the different age at marriage, but mainly because men remarried more often.

Table 6: Marital status and presence of children for adult males and females registered in the polyptych

	Men		**Women**		
	With children	**Without children**	**With children**	**Without children**	**Total**
Married	*123*	*28*	*124*	*28*	*303*
Unmarried	*24*	*63*	*41*	*41*	*169*
Total	*147*	*91*	*165*	*69*	*472*
Married (column %)	84	31	75	41	64
Unmarried %	16	69	25	59	36
Total	100	100	100	100	100

If we examine the data from a different perspective and consider only unmarried individuals (Table 7), we obtain the same results as above: there is a higher proportion of individuals without children among men compared to women. This indicates a higher proportion of bachelors than maidens, once again suggesting a later age at marriage for males. Moreover, as discussed above, boys and girls began to be described as *baccalari* once they reached the age of about 12. Women continued to be defined as such until they married, and almost all wed at some point. Indeed, among adult women we find a very high percentage of married individuals. While males were described as *baccalarius* up to a similar age as that of women, they then ceased to be defined as such, entering adulthood after 22 years of age regardless of whether or not they were married. This also helps to explain why we find a greater proportion of unmarried adult males. The definition of *baccalarius/a* thus seems to refer more to the life cycle than to marital status. This hypothesis is supported by both the proportionate sex ratio between male and female *baccalari* and by the balanced percentage of *baccalari* compared to the remaining age classes, as seen above.

Table 7 also shows that there is a higher proportion of individuals with children among unmarried women than among men, suggesting again that men tended to remarry more often than women after being widowed. This hypothesis is also supported by the fact that no males are registered as widowers, while 17 women are explicitly described as *vidua*.

These results show that the marriage system in this period and area was not much different from that observed in France at the beginning of the Modern Era, when males married later than females and more often remarried (for a reconstruction of 17th century French population and marriage dynamics see Charbonneau et al. 1987).

Table 7: Unmarried individuals with and without children

	Males	Females	Total
With children	*24*	*41*	*65*
Without children	*63*	*41*	*104*
With children (row %)	37	63	100
Without children (row %)	61	39	100

5. Families and farms

We now turn to the internal composition of the 145 inhabited farms listed in the document. Farms were populated by individuals, single family units, or several units together, up to 43 components. We do not, however, know how residence was organized or whether different units listed for the same farm effectively lived together, but rather only that they worked together on the same farm. Moreover, the registered kinship ties refer to nuclear units: "husband of," "wife of," "daughter of," and "son of." In only a few cases it is thus possible to discern the relationship between different family units working on the same farm. One clue to this regard is the average number of individuals per farm (MFS: Mean Farm Size). In Provence, the MFS is 8 individuals per farm (considering only those inhabited), much greater than the 4.7 reported for the Farfa farms of Abruzzi. The MFS found in Provence is, in fact, quite high; Burch (1972) estimates that with a life expectancy at birth of 20 years, even with high fertility (gross reproduction rate R=4), the average number of individuals per nuclear family was 4.8. In England between 1574 and 1821 the highest average number of individuals found per household is 7 (Laslett, 1972b and Wall, 1972). These results suggest that a high proportion of the Provençal farms were likely run by extended groups not closely related to one another, perhaps better defined as "working groups." We consequently do not use Laslett's household classification, as it does not seem appropriate here.

Of the 145 farms, 53 (37%) were inhabited by one nuclear unit (couples with or without children, singles, or widowers with children), while 26 farms (18%) were populated by one nuclear unit composed of a couple with children and some individuals whose relationship with the head of the family is not defined. Forty-two farms (29%) were occupied by two or more nuclear units, of these 29 (20%) included units not apparently related to one another, while 13 (9%) had related groups, mainly sons who continued to live with their family of origin, together with their own wives and children. For this last type of farm, Laslett's "extended down" household could be applicable. Twenty-four farms (17%) were inhabited by singles or apparently unrelated individuals. The high frequency of farms registered as having nuclear units together with unrelated members, or several nuclear units together is interesting and seems to contradict the particular attention paid by the polyptych editors to the nuclear family.

These results are also quite distinct from those documented for the hilly and mountainous region of Abruzzi in Italy for the same period, where most of the farms (65%) were occupied by only one nuclear unit, showing that in the distant past as well, European family settlements were far from homogeneous (Dalla-Zuanna et al. 2012).

In the case of Provence, it is of interest to consider the organization of different farms in relation to their geographical location (Table 8). Among farms managed by one nuclear unit, 44% are found in the plains or low hills, compared to only 28% in the mountains. In the Alps, many farms were managed by two or more units. In particular, 11% of such farms were managed by 2 or more related units (mainly the head of the farm with his wife, children, and his children's families), while a majority (26%) were managed by several apparently unrelated units. This last type of farm organization is much less common in the plains/hills (9%), reflecting different forms of cooperation

depending on the environmental location of the farm (Faith 2010). The polyptych shows that farms in the Alps were not only generally more inhabited than those in the plains/hills but were also relatively more densely inhabited. Why? Consideration, in the following section, of farm heads' relationship to the Abbey helps to shed light on this question.

Table 8: Organization of farms according to altitude (99 populated and geo localized farms). Row %.

	Nuclear units	Nuclear units with unrelated members	Two or more related units	Two or more units without relation	Other types	Total (*Absolute values*)
Plain and hills	44	21	12	9	15	100% (*34*)
Mountains	28	17	11	26	18	100% (*65*)

6. Heads of farms

Each head of the farm (or the first name listed, a male in 83% of the cases) is described in the document as having certain attributes — *beneficiarius, colonus, mancipium, accola, cotidianus, verbecarius, artifex* — indicating different roles and obligations towards the owner of the farm, Saint Victor of Marseille. In classical Latin the term *mancipium* (plural *mancipia*, gender neutral, as if it were a thing rather than a person) denoted slave (Devroey 2000, Rio 2017), or those who were strictly tied to the land and transmitted this bond to his/her descendants, while *colonus* (female: *colona*, plural *coloni* or *colonae*) were free individuals, less firmly attached to the owner and the land. Scholars agree that during the early medieval period these terms were still in use but had more nuanced meanings (Weinberger 1990; Devroey 2000; Wickham 2005; Rio 2017).

That said, these descriptors strongly reflect the ways farms were organized. As seen in Table 9, *coloni* were the heads of farms mostly run by a single nuclear unit, while *mancipia* largely headed farms with two or more nuclear units, perhaps because the latter and their descendants were less free to move. This hypothesis is supported by the fact that there are 24 foreign husbands (*maritus extraneus*) out of a total of 35 inhabited farms where the head was defined as *mancipium*, while only 3 lived on a farm where the head was a *colonus*, suggesting that husbands likely came onto the wife's farm when she could not move from the land.

Table 9: Relation between type of head of farm and farm organization (column %)

	Colonus/a	Mancipium	Other	Total
Single	0	3	22	11
Without relation	0	6	9	5
Nuclear unit	46	23	37	37
Nuclear units with other members	35	11	11	18
Two nuclear units or more	19	57	21	29
Total	100	100	100	100
Absolute values	*43*	*35*	*67*	*145*

Interestingly, *mancipia* tended more often to be the heads of farms located in the Alps while farms headed by *coloni* were equally distributed among the plains, hills, and mountains (see Table 10). The greater presence of *mancipia* in the mountainous areas may have been due to the need of the monastery to control its more distant, disputed, and unstable areas. Being more permanently linked to the land and in direct contact with the monastery, the *mancipia* would have helped to guarantee more stability in production and greater control over such areas, which were easily reclaimed by local lords (Poly 1976; Rio 2017).

Table 10: Relation between the type of head of farm and location of farm (column %)

	Colonus/a	Mancipium	Other	Total
Plains and hills	28	17	13	19
Mountains	28	54	27	34
Unknown	44	29	60	47
Total	100	100	100	100
(Absolute values)	*43*	*35*	*67*	*145*

We also compare the structure of the population on farms headed by *mancipia* compared to the other farms. The proportion of young individuals is higher on farms headed by *mancipia*, which might be explained by the mobility of youth. In fact, among farms headed by *mancipia* we observe a higher proportion of females *baccalariae* who are not daughters of the farm members and thus were not born on that same farm. More specifically, on farms headed by *coloni* or other categories, female *baccalariae* were, in 33% of the cases, not related to the other farm members, while on farms headed by *mancipia* this same category equals 41%, indicating a higher in-mobility of young females on these farms.

Taken together, these data suggest that young individuals moved from one farm to another, more often leaving farms that were not headed by a *mancipium*. On the contrary, on farms headed by *mancipia*, mainly distributed in the mountains and more densely inhabited, younger individuals moved in, possibly a relocation strategy managed by the monastery aimed at positioning its workforce in the more complex terrain of the Alps.

7. Conclusions

The data discussed in this paper offer several important insights into the demographic dynamics of Early Medieval Southern France. While the population of the farms of the Abbey of St. Victor of Marseille was scattered over a wide area, we show that it represents a substantial group of more than one thousand people, with a balanced sex ratio and a coherent age structure. For most of these individuals, we know their name, kinship relation within their family, indication of adolescent status, employment or servitude tie to the monastery, marital status, and geographical location of the farms. Furthermore – perhaps for the first time in European history – the analytical age of children under 12 is also systematically detected. The data allow to derive, directly or indirectly, a wide range of demographic and social information, and to compare the latter with (the relatively scant) available evidence on medieval European demography. We conclude by summarizing the main results.

First, our analyses and simulations show that the age structure of the population of the polyptych of Marseille was similar to that observed in another medieval context (Legnago 1420), and not very different from the Tuscan Cadastre of 1427. These three age structures are older than those observed during the years of fast post-plague population recovery, but clearly younger than after the plague era in England in 1696 and France in 1740. The birth (and death) rate may have been around 50‰ and mortality around e_0=20, close to that observed when processing data on the age of skeletons in the cemeteries of Southern France during the first millennium AD. Fertility could have been 7-8 children per woman, close to that of Legnago in 1420.

Second, data on marital status suggest a marriage system similar to that of Southern France many centuries later, during the Modern Era. Women married earlier than men at relatively young ages, possibly around 21 years of age, and second or third marriages mainly occurred for men. This regime is also partly compatible with marriage trends documented by other early medieval written

sources related to aristocratic families, which show different ages at marriage for men and women, together with considerable kin group tensions over the second marriage of widows (Nelson 1995; Le Jan 1996; La Rocca 2005).

Third, the organization of farms greatly depended on location. Highland farms tended to be more populated. This might in part have been a strategic effort on the part of the Abbey to keep or settle *mancipia* as heads of farms in more challenging areas in order to maintain a stronger bond. The data indicate that despite fluidity in the use of the terms *colonus*, *mancipium* etc., there were indeed differences, with *mancipia* being a more strictly servile status. *Mancipia* brides were not permitted to leave the farm, but rather it was the groom who moved in. Young girls also came in, possibly as domestic servants or some sort of workforce. Differently, on farms headed by *coloni* or linked to the Abbey by less strict ties, people moved more freely. These farms were also less populated and more commonly run by single family units, as young men and women were able to depart and settle with their new families elsewhere.

The presence of densely inhabited farms would suggest that this population tended to increase, or better, that there existed a stop-and-go dynamic where some farms were depopulated and others were crowded. This can happen in a high mortality regime, even in the absence of significant epidemic outbreaks. It is possible that legal constraints related to the land made it difficult to achieve a spontaneous balance, which instead occurs when people are free to move. The empty farms in the plains listed in the document may, in fact, have been waiting for new settlers to be displaced from the more populated highland farms. This would support the hypothesis that the polyptych was drawn up to decide how to organize the workforce (Carrier 2012).

Differences in the density of human settlement on farms in the area under consideration here was clearly connected to varying degrees of ties to the land and the landowner, anticipating trends observed in Europe in later historical periods. It has, in fact, been clearly shown that in modern times there were no rigid and perpetuated family structures. Working groups and families adapted to environmental and economic systems (Le Play 1855; Cocchi et al. 1996; Viazzo 2010). Methods of production, agricultural structures, bonds to the land, and the system of property transmission all influenced nuptiality, fertility, and household organization (Delille 1977 and 1985; Kertzer and Barbagli 2001).

This study shows that it is possible and appropriate to intensively use data available in medieval or modern cadastres or similar sources, in that the sex/age/marital status/family structure information contained therein can shed light on population dynamics. These resources can also be used in conjunction with archaeological and documentary evidence on population density and growth, as well as data on mortality and health derived from skeletons (Barbiera 2012; Steckel 2019). Such a multi-faceted approach promises to help elucidate many aspects of medieval European demography.

References

Barbiera, I. & Dalla Zuanna, G. (2009). Population Dynamics in Italy in the Middle Ages: New Insights from Archaeological Findings. *Population and Development Review*, 35(2), 367-389.

Barbiera, I. (2012). "Si masculi superassent foeminas". Sex ratio et mortalité féminine au Moyen Âge en Italie*. Mélanges de l'École Française de Rome. Moyen age,* 124(2), 547-565.

Barbiera, I., Castiglioni, M. & Dalla-Zuanna, G. (2017). Missing women in the Italian middle ages?

Data and interpretation. In S. Huebner and G. Nathan (Ed.), *Mediterranean families in Antiquity. Households, Extended Families and Domestic Space* (283-309). Malden, Oxford: Wiley-Blackwell.

Barbiera, I., Castiglioni, M. & Dalla-Zuanna, G. (2018). A synthetic measure of mortality using skeletal data from ancient cemeteries: the d index. *Demographic Research*, 38, 2053-2072.

Bardet, J.-P. & Dupaquier, J. (Eds.) (1997). Histoire des populations de l'Europe. Paris: Fayard

Bautier, H. R. (1988). Haut Moyen Age. De la dissolution de l'Empire romain au grand élan économique et démographique du XI^{e} siècle. In J. Dupâquier (Ed.), *Histoire de la population Française*, (119-206). Paris: Quadriage.

Bergh, A. (1941). *Études d'anthroponymie provençale. Les noms de personne du polyptyque de Wadalde (a. 814)*. Göteborg: Elanders Boktryckeri Aktiebolag.

Biraben, J.-N. & Le Goff, J. (1975). *The plague in the early Middle Ages. I*n J-N. *Biraben (Ed.) Biology of man in history*. Baltimore: Johns Hopkins University Press.

Biraben, J.-N. (1975). *Les Hommes et la peste en France et dans les pays europèens et mediterranées*. Paris: La Haye.

Burch, T. K. (1972). Some demographic determinants of average household size: An analytic approach. In Laslett, P. & Wall, R. (Ed) *Household and Family in the Past. Comparative studies in the size and structure of the domestic group over the last three centuries in England, France, Serbia, Japan and colonial North America, with further materials from Western Europe,* (91-102). Cambridge: Cambridge University Press.

Carrier, N. (2012). *Les usages de la servitude: Seigneurs et paysans dans le royaume de Bourgogne (VI^{e} XV^{e})*. Paris: PUPS.

Charbonneau, H., Guillemette, A., Légaré, J., Desjardins, B., Landry, J. & Nault F. (1987). *Naissance d'une population. Les Français établis au Canada au XVII siècle*. Paris: INED.

Coale, A. & Demeny, P. (1983). *Regional model life tables and stable population – second edition*, New York: Academic Press.

Cocchi, D., Crivellaro, D., Dalla Zuanna, G. and Rettaroli, R. (1996). Nuzialità, famiglia e sistema agricolo in Italia, negli anni '80 del XIX secolo. *Genus*, 52 (1/2), 125-159.

Dalla Zuanna, G., Di Tullio, M., Leverotti, F. & Rossi F. (2012). Population and Family in Central and Northern Italy at the Dawn of the Modern Age. A Comparison of Fiscal Data from Three Different Areas. *Journal of Family History*, 37(3), 284-302.

Delille, G. (1985). *Famille et propriété dans le Royaume de Naples, 15e-19e siècle*. Rome: Éditions de l'École des hautes études en sciences socials.

Devroey, J.-P. (1981). Les méthodes d'analyse démographique des polyptyques du haut Moyen Âge. *Acta Historica Bruxellensia* 4, 71-88.

Devroey, J.-P. (1985). Polyptyques et fiscalité à l'époque carolingienne. Une nouvelle approche? *Revue belge de philologie et d'histoire* 63, 783-794.

Devroey, J.-P. (1993). *Études sur le grand domaine carolingien*. Aldershot: Variorum Collected Studies Series.

Devroey, J.-P. (2000). Man and Women in Early Medieval Serfdom: The Ninth-Century North Frankish Evidence. *Past and Present* 166, 3-30.

Devroey, J.-P. (2004). Élaboration et usage des polyptyques. Quelques éléments de réflexion à partir de l'exemple des descriptions de l'Église de Marseille (VIII^{e}-IX^{e} siècles). In D. Hägermann, W. Haubrichs, J. Jarnut, C. Giefers (Ed). *Akkulturation. Probleme einer germanisch-romanischen Kultursynthese in Spätantike und frühen Mittelalter* (436-472). Berlin, New York: Walter de Gruyter.

Etienne, R. (1988). Gaule Romaine. In J. Dupâquier (Ed.) *Histoire de la population Française* (65-117). Paris: Quadriage.

Faith, R. (2010). Farms and families in ninth-century Provence. *Early Medieval Europe* 18 (2), 175-201.

Feller, L. (1994). La population abruzzaise durant le haut moyen age: les conditions de possibilité d'une croissance démographique (VIII^{e}-IX^{e} siècles). In R. Comba & I. Naso (Eds.), *Demografia e società nell'Italia medievale. Secoli IX-XIV* (327-349). Cuneo: Società per gli Studi Storici, Archeologici ed Artistici della Provincia di Cuneo e Società Italiana di Demografia Storica.

Grabill, W. H., & Cho, L.-J. (1965). Methodology for the Measurement of Current Fertility from Population Data on Young Children. *Demography* 2, 50-73.

Green, M. H. (2014). Tanking Pandemic Seriously: making the Black Death Global. In M. H. Green, (Ed.), *Pandemic Disease in the Medieval World. Rethinking the Black Death*, (27-61). Kalamzoo and Bradford: ARC Medieval Press.

Halsall, G. (2007). *Barbarian Migrations and the Roman West. 376-568*. Cambridge: Cambridge University Press.

Harvey, S. (1988). Domesday England. In , H. E. Hallam (Ed.), *The Agrarian History of England and Wales*, Vol. II, 1042-1350 (45-136). Cambridge: Cambridge University Press.

Haubrichs, W. & Jarnut, J. (Eds.) (2004). *Akkulturation. Probleme einer germanisch-romanischen Kultursynthese in Spätantike und frühem Mittelalter* (436-472). Berlin-New York: Reallexikon der germanischen Altertumskunde: Ergänzungsbände, 41.

Henry, L. & Blayo, Y. (1975). La population de la France de 1740 à 1860. *Population* 30 (1), 71-122.

Henry, L. & Houdaille, J. (1979). Célibat et âge au mariage aux XVIIIe et XIXe siècles en France. II. Age au premier mariage. *Population*, 34/2, 403-442.

Herlihy, D. & Klapisch-Zuber, C. (1988). *I toscani e le loro famiglie. Uno studio del catasto fiorentino del 1427*. Bologna: Il Mulino.

La Rocca, C. (2005). Rituali di famiglia. Pratiche funerarie nell'Italia longobarda. In F. Bougard, C. La Rocca & R. Le Jan (Eds.), *Sauver son âme et se perpetuer. Trasmission du patrimoine et mémoire au haut Moyen age*, (431-475). Roma : l'École française de Rome.

Laslett, P. (1972a). Introduction. In Laslett, P. (Ed), *Houshold and Family in the Past* (1-89). Cambridge: Cambridge University Press.

Laslett, P. (1972b). Mean household size in England since the sixteenth century. In P. Laslett (Ed.), *Houshold and Family in the Past* (126-158). Cambridge: Cambridge University Press.

Le Jan, R. (1996). *Famille et pouvoir dans le monde franc (VIIe-Xe siècle): essai d'anthropologie sociale*. Paris: Publications de la Sorbonne.

Le Play, F. (1855). *Les ouvriers européens: Etudes sur les travaux, la vie domestique et la condition morale des populations ouvrières de l'Europe, précédées d'un exposé de la méthode d'observation*. Paris: Imprimerie impériale.

Little, L. K. (2008). Life and Afterlife of the First Plague Pandemic. In L.K. Little (Ed.), *Plague and the End of Antiquity*. *The Pandemic of 541-750.* (3-32). Cambridge: Cambridge University Press.

McEvedy, C. & Jones, R. (1978). *Atlas of World Population History*. London: Penguin Books.
Nelson, J. (1995). The wary Widow. In W. Davis & P. Fouracre (Eds.), *Property and Power in Early Medieval Europe* (82-113). Cambridge: Cambridge University Press.

Poly, J.-P. (1976). *La Provence et la société féodale: 879-1166, contribution à l'étude des structures dites féodales dans le Midi*. Paris: Bordas.

Renard, E. (2012). Grandes propriétés et organisation domaniale dans le Midi de la Gaule à l'époque carolingienne : que peut-on savoir ? *Revue belge de philologie et d'histoire*, *90* (2), 381-412.

Ring, R. (1979). Early Medieval Peasant Households in Central Italy. *Journal of Family History*, 4 (1), 2-25.

Rio, A. (2006). Freedom and Unfreedom in Early Medieval Francia: The Evidence of the Legal Formulae Author(s). *Past and Present* 193, 7-40.

Rio, A. (2017). *Slavery after Rome. 500-1100*. Oxford: Oxford University Press.

Rossi, F. (2013), Famiglie e proprietà a Legnago nel 1430: Collegamento di dati demografici e fiscali. Parte I, popolazione e famiglie. *Popolazione e Storia* 1/2013, 153-198.

Sauze, E. (1984). Le polyptyque de Wadalde: problemes de toponymie et de topographie provençales au IX^{e} siecle. *Provance Historique*, 34, 3-33.

Scheidel, W. (2001). Progress and problems in Roman demography. In W. Scheidel (Ed.), *Debating Roman demography* (1-81). Leiden: Brill.

Steckel, R. H., Spenser Larsen, C., Roberts, C. A., Baten, J. (2019). *The Backbone of Europe. Health, Diet, Work and Violence over Two Millennia*. Cambridge: Cambridge University Press.

Vallin, J. (1989). La mortalité en Europe de 1720 à 1914 : tendances à long terme et changements de structure par sexe et par âge. *Annales de démographie historique. Le déclin de la mortalité.* 31-54.

Vallin, J. (2006). Europe's Demographic Transition. In G. Caselli, J. Vallin & G. Wunsch (Eds.), *Demography: Analysis and Synthesis*, (41-66). London: Elsevier.

Viazzo, P. P. (2010). Family, kinship and welfare provision in Europe, past and present: commonalities and divergences. *Continuity and Change*, 25, 137-159.

Wall, R. (1972). Mean household size in England from printed sources. In P. Laslett (Ed.), *Houshold and Family in the Past* (160-203). Cambridge: Cambridge University Press.

Weinberger, S. (1973). Peasant Households in Provence: ca. 800-1100. *Speculum*, 48 (2), 247-257.

Weinberger, S. (1990). La transformation de la société paysanne en provence médiévale. *Annales* ESC, 1, 3-19.

Wickham, C. (2006). *Framing the Early Middle Ages: Europe and the Mediterranean, 400-800*. Oxford: Oxford University Press.

Wiechmann, I. & Grupe, G. (2005). Detection of Yersinia pestis DNA in Two Early Medieval Skeletal Finds from Aschheim (Upper Bavaria, 6th century A.D.). *America Journal of Physical Anthropology*, 126, 48-55.

Woods, R. (2007). Ancient and Early Modern Mortality. Experience and Understanding. *The Economic History Review*, 60 (2), 373-399.

Wrigley, E.A. & Schofield, R. (1989). *The population History of England 1542-1871*, Cambridge: Cambridge University Press.

Zerner-Chardavoine, M. (1981). Enfants at jeunes au IX^{e} siècle. La démographie du polyptique de Marseille 813-814. *Provence Historique*, 31 (126), 355-384.