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Cilliers, Jeanne; Mariotti, Martine

2018

Document Version:
Other version

[Link to publication](#)

Total number of authors:
2

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Lund Papers in Economic History

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Eighteenth and Nineteenth Century South African Demographic History Reconsidered[§]

Jeanne Cilliers[†] and Martine Mariotti[‡]

Abstract

Using South African Families (SAF), a new database of settler genealogies, we provide the first comprehensive analysis of women's fertility in settler South Africa between 1700 and 1900. Differences in parity rates across geographic regions suggest couples knew how to limit fertility prior to the global onset of the first fertility transition. We date the start of South Africa's fertility transition to cohorts born in the 1850s, having children from the 1870s. This timing is similar to other settler communities and earlier than many European countries despite somewhat different economic and social circumstances.

Keywords

South Africa, Fertility, Genealogies, Settler demography

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1. Introduction

Women's fertility dropped substantially across most developed countries in the second half of the nineteenth century, a phenomenon known as the fertility transition. Children per woman fell from numbers such as seven, eight or even nine children to lows ranging between three to five children. The causes of the transition continue to be debated. Suggested answers range from the transition being a result of macroeconomic factors such as structural change, microeconomic factors such as changing costs of children, and social and cultural factors. One important question is whether the late nineteenth century heralded an innovation in birth control measures or whether existing methods of birth control began to be applied to achieve lower fertility levels, termed adaptation or adoption in the literature (Carlsson 1966, Knodel 1977, Bean et al. 1991, Guinnane 2011).

Arguments in favor of adaptation suggest that families were already practicing some form of birth control, simply at a higher level, before the transition (Guinnane 2011). There is evidence of differences in fertility levels between urban and rural areas and within rural areas that differed by type of agriculture or period of settlement prior to the transition. Arguments in favor of innovation suggest that prior to the fertility transition parity-specific fertility control was largely absent (Knodel 1977). Post innovation we should see fertility limitation initiated by the urban middle and upper classes, spreading within the urban area and then spreading with a lag to rural areas. However, discerning whether rural fertility declines take place after urban because of the time it takes for an innovation to spread or because of the different circumstance of rural households is not easy. There is therefore still some doubt as to the importance of innovation versus adaptation.

This paper serves two purposes. Using new data from South African Families (SAF), a recently digitised genealogical database we join the debate about adaptation versus innovation where innovation has been argued to be a driver of the demographic transition. Second, we determine the timing of the onset of South Africa's settler fertility transition and place this in the context of other settler transitions as well as the European transition.

South Africa is well suited to an examination of differential fertility behavior by urban-rural setting, settlement-timing, the carrying capacity of settled land, regional labor demand, and the size of land bequests. Following the first arrival of Dutch settlers to Cape Town in 1652, European expansion steadily spread north eastwards incorporating both

arable as well as agriculturally and territorially hostile regions. Our data record the birth histories of the settlers from 1700 - 1910 as they spread out from Cape Town and into the rest of the country throughout the 1700s and 1800s. While other genealogical datasets and individual level birth histories have been used to examine women's fertility in the nineteenth century (Bean et al. 1991, Moyle 2015) no other study has been able to follow 200 years of settlement across cultures and regions as we do here.

Our genealogical data allow us to look at completed female fertility by cohort. We therefore focus on total number of children per woman, what we call parity, rather than number of births per year. The data show a steady average parity for the first 150 years, with a marginal decline from an average of seven and a half children per married woman in the eighteenth century to an average of six and a half for women born in the first half of the nineteenth century. In this pre-transition period, there are regional fertility differences based on period of settlement, land availability and quality, and population density. Frontier regions experience high fertility initially but within a decade of settlement parity reduces and converges to that of more established rural areas. Urban fertility is on a par with rural in the eighteenth century but begins to decline more rapidly for women born in the last 30 years of the nineteenth century. Our findings suggest early fertility limitation during the nineteenth century *prior* to the onset of the fertility transition which is consistent with the adaptation argument rather than the innovation argument.

In the second half of the nineteenth century we see a steady decline in the number of births per married woman to three and a half children for women born between 1900 and 1909. The decline in fertility starts for women born in the third quarter of the nineteenth century between 1850 and 1875 and for whom childbearing would have occurred between approximately 1865 and 1920. Parity declines take place across all geographical regions almost simultaneously. By the end of our period of study, urban parities are lowest, followed by the most recently settled frontier regions with the earliest settled rural regions having the highest parity.

The observed fertility decline coincides with an increase in age of first marriage as in Voigtlander and Voth (2013), an increase in mother's age at first birth, and an increase in birth spacing. Parity decreased across cohorts regardless of the age at which a woman began having children. The evidence suggests that it was an entire cohort that initiated a decline in parity rather than a decline in fertility starting at a particular time across all fertile cohorts. Although we do not focus on the causes of the transition in

this paper, we can eliminate, simply through examining the timing of the transition, the possibility that economic structural change brought about by the onset of industrialization is responsible for the transition. We also briefly examine cultural differences in fertility rates and find none.

We find that parity in South Africa was very similar to Europe as well as to other settler societies. Crucially, despite the very different socio-economic conditions relative to the European nations undergoing industrialization in the second half of the nineteenth century, the demographic patterns appear very similar, particularly with respect to the timing of the fertility transition. Unlike in Europe but very much as in other settler societies, the South African fertility transition began prior to the substantial economic changes that took place in the two colonies and two independent republics at the end of the nineteenth century following the mineral discoveries in the interior (Falconer 2003).

The advantage of our cohort parity data is that we need not make the assumptions and calculations required when using census or other population data to undertake demographic analysis (Coale and Watkins 1986). Nevertheless, we do provide an estimate of Coale's I_g to compare to other studies. We do run the risk of our data not being fully representative of the population. Although our genealogical data contain all progenitors of settler families in South Africa, the data do not record the marriages and deaths of all descendants and in that sense, individuals leave the sample throughout our period of study. The concern is that the sample is then biased towards the very fertile and is not representative of the settler population. To deal with this concern we provide comparisons to population estimates as well as comparisons to census data, where possible, to confirm that our data do not suffer from systematic omissions.[1] Where our data are not representative is with respect to race. Due to the nature of race relations throughout South Africa's colonised history, no systematic attempt was made to record the populations of the indigenous Khoisan peoples, African tribes, people of mixed racial descent and those from the Asian subcontinent with the result that our study is restricted to the white settlers of South Africa.

Until now, much of the discussion on white settler fertility in South Africa has been based on anecdotal evidence which has suggested exceptionally high completed fertility (Shell 2005). For example, Penn (2014) describes in 1727, a woman in her early 30s already the mother of

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[1] This discussion is in the data appendix.

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seven children, who would go on to bear 11 children in all. Ross (1975) refers to a woman dying at the age of 49 at the birth of her twelfth child, whose husband would incidentally go on to father another 12 children with his second wife. The primary reason for absence of analysis on this topic is a shortage of adequate data. Our data allow us to begin to fill that gap.

There are two other notable studies of fertility in settler South Africa. Our finding of slightly over seven children per woman until around 1820 is consistent with the completed fertility calculated in Gouws (1987) who finds, using a much earlier version of our data ending 1819 with far fewer observations, that between 1735 and 1819 women had between 6.8 and 8.5 children over their lifetime. Simkins and van Heyningen (1989), using two waves of census data, 1891 and 1904, provide estimates of the crude birth rate in 1891-96, 1896-1901 and 1901-06 of 40.7, 35.0 and 29.9 finding, as we do, a fertility decline over the time period. Our crude birth rates are 27 in 1895, 20.7 in 1900 and 22.3 in 1905.[2]

The paper proceeds as follows: section 2 provides a brief summary of factors that influence the desire to have children in a predominantly rural setting such as South Africa. Section 3 discusses the social and economic context within which this study takes place. Section 4 introduces the dataset and provides summary information. Section 5 provides the demographic context within which families made decisions regarding child bearing by looking at the gender age profile of the sample over time as well as the average length of life. Section 6 conducts the main characterization of the fertility history, section 7 concludes.

2.   Conceptual discussion

The story of settler South Africa as it relates to childbearing is largely rural, influenced by: internal migration of European settlers, land acquisition and dispossession, conflict with indigenous populations, labor shortages, livestock farming, the closing of old frontiers and the opening of new frontiers, and the partible inheritance system. Secondary developments include the growth in urban centers of small-scale manufacturing and in the last three decades of the nineteenth century, the discovery of rich mineral deposits.

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[2] The crude birth rate is the number of births per 1000 of the population of a given geographic area.

Within the rural agricultural environment there are several factors that could play a role in determining family size. First, frontier areas might experience high fertility rates as couples face fewer space constraints. The availability of unsettled land (by Europeans) could lead to large farms that remain viable even when divided amongst many heirs. As the frontier is settled and farms become smaller upon inheritance, family size declines in order to maintain the value of bequests (Easterlin 1976). In this environment we expect to see high fertility at initial settlement on the frontier followed by lower fertility rates in subsequent years.

Second, labor supply and demand have influences on family size. Low population density could lead to large family sizes where children are expected to meet family labor requirements. This could be mitigated if there are other laborers available, such as the indigenous population in South Africa, that are willing to work or can be coerced. Differences in labor requirements based on the type of agriculture could also result in different family sizes (Craig 1989, 1991). Crop production is known to require higher labor inputs than live-stock rearing (Voigtlander and Voth 2013). It may therefore be the case that crop farming regions see larger families relative to pastoralists especially in cases where there are labor shortages.

Third, the general carrying capacity of the land over and above determining the need for labor could determine how many people can be sustained within a household. As we show below, in South Africa's case, agricultural activity varied across the established settled regions and the newly settled regions predominantly due to differences in the suitability of land for farming activity. Live-stock rearing was the dominant livelihood in the frontier regions in part due to poor carrying capacity of the land. Therefore, *ceteris paribus* we should see lower fertility in arid regions than in more fertile regions.

Fourth, in South Africa's case, conflict over land at the frontier could have played a role in family size determination, limiting the ability to settle new land and restricting family size as in the first point above. Yet, the particular approach to dealing with the conflict in South Africa which was to send out small bands of armed settlers, could have increased the need for male children, having the opposite effect on family size.

Fifth, family sizes in rural and urban areas are likely to differ due to differing costs of children, the availability of education as well as other consumption alternatives. Easterlin (1971) notes how older established urban areas are likely to have lower fertility than new urban areas where consumption alternatives are still to arrive. Urban areas are likely to have

lower fertility than rural areas due both to space constraints as well as the prevalence of consumption alternatives and other costs. He notes too that family sizes within rural areas are likely to differ based on whether the rural area is well established with access to education or whether it is a frontier area with few alternative costs. Finally, fertility differences have been shown to be influenced by socio-economic status and by cultural affiliation (van Bavel and Kok 2005, Bengtsson and Dribe 2014, Molitoris and Dribe 2016).

3. Settler conditions and the demand for children

The Cape Colony was first settled in 1652 by the Dutch East India Company (Vereenigde Oost-Indische Compagnie, hereafter VOC) as a refueling station for Dutch ships on their way to Asia. Shortly after initial settlement, retired officers of the VOC spread out around Cape Town with the intention of establishing farms to supply passing ships. The immediate countryside surrounding Cape Town as far as the first mountain ranges enjoyed winter rainfall with soil suitable for the cultivation of wheat, fruit and vegetables, and wine. Low settler population numbers resulted in chronic labor shortages on these farms, alleviated only by the advent of slave importation in 1658 and the subjugation of the local indigenous Khoi (Gilliomee 2003, 12). Economic activity was fairly diversified with occupations ranging from farming to artisanal employment and service provision (Fourie 2013). Cape Town was the economic center and remained so until the development of Johannesburg at the end of the nineteenth century. We hereafter refer to Cape Town as Old Urban, in line with Easterlin (1971).

The VOC continued to encourage migration from the Netherlands and other European countries to the Cape. While some of these migrants remained in Cape Town, it was stock farming that set the precedent for continual migration away from Cape Town into the surrounding hinterland. The need for good pasture for growing herds and land for the burgeoning population saw the movement of settlers towards the coastal mountain ranges beyond Cape Town where rainfall was still reliable and the local indigenous population easily subdued. In time, a small landed gentry arose consisting of independent wealthy land owners not affiliated to the VOC. The hinterland was close enough to Cape Town that farmers could participate in the local slave trade thereby meeting some of their labor needs.

Along the south East Coast, rainfall was sufficient to support both wheat cultivation and stock farming and settlers continued eastwards until migration was halted by conflict with the southward migrating Nguni tribes. These coastal districts were settled later than the hinterland districts close to Cape Town but still during the Dutch colonial period. In the analysis we consider them together with the hinterland districts due to the century of settlement, availability of water, and type of cultivation. Access to labor is however not the same as for the hinterland, the East Coast districts were sufficiently far from Cape Town to have incurred greater costs in the slave market.[3] When we discuss regional differences in fertility we will refer to both the hinterland northwards to Piketberg and the East Coast up to but not including Port Elizabeth as Old Rural Arable.

Continuous immigration into the Colony coupled with the partible inheritance system spurred inland migration in search of new land.[4] North of Piketberg along the west coast and north-eastwards over the Cape Fold Mountain ranges (the Boland, Hex River, Langeberg and Swartberg Mountains), limited rainfall led to specialization in stock farming. This required fewer resources and capital outlay and was arguably less labor intensive than crop cultivation. Conflicts with the indigenous Khoi population groups over land and water access as well as over livestock raids halted migration in both these directions for a time. Within this territory, farm sizes were large and the population was widespread. Thompson (2001, 47) notes that out of the 13 830 burghers (free citizens) in the Cape Colony in 1793, 3 100 were in the vast eastern district of Graaff-Reinet, and 1 925 in the south-eastern district of Swellendam. Due to the distance from Cape Town and the length of time it took to get there (three months from Graaff-Reinet), the homesteads of the *trekboers* (Dutch for migrating farmers) became relatively self-sufficient, albeit with far fewer luxuries than in the south western Cape.

The settlers' superior armament coupled with implicit support from VOC officials resulted in the eventual subjugation of the local Khoi into a servant class by the late eighteenth century thereby alleviating labor

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[3] Slavery at the Cape was limited in scale relative to the plantations of the Caribbean and Southern United States. Fourie (2013) notes that out of a sample of probate records at the Cape, 34 % of the probates showed no slave ownership and that the mean number of slaves owned was 5. This evidence is corroborated in Thompson 2001.

[4] With partible inheritance property is split equally between the surviving spouse and the children (with the spouse inheriting half and the children the other half in equal amounts). The result was ever-decreasing farm sizes or the payout of those relatives willing to move on both of which increased the demand for land.

shortages to a degree (Penn 1989, 13). Thompson (2001, 49) notes that raids on Khoi settlements, frequently carried out under the pretext of livestock recovery, often resulted in the capture of Khoi women and children who were shared out amongst the members of the commando and put to work as servants in the homestead.[5] We treat the vast arid interior from Clanwilliam eastwards through Worcester, Beaufort until Albert as one region, calling it Old Frontier.[6] This was the extent of the Cape Colony by the end of the Dutch period. Land shortages were, however, never eliminated and settlers without access to land continued to push northwards and eastwards in search of new pasture (Gilliomee 2003, 30).

In 1806 the British occupied the Cape resulting in the formation of two distinct groups of settlers within the Colony. The first were those who had come prior to the British occupation from all over Europe , and assimilated into the *Afrikaners*, a Dutch speaking group, over the eighteenth century. The second were those of British origin speaking English who settled either in the well-watered, conflict prone, Eastern rural districts of the Cape Colony or, when farming endeavors were unsuccessful, moving as artisans into the local towns.

During the first half of the nineteenth century the pattern of life in the Cape Colony remained somewhat stable despite the change in colonial authority. The local economy grew albeit slowly, specializing in agriculture with manufacturing and services concentrated in three main towns; Cape Town in the south-west, and the smaller Port Elizabeth and East London in the east.

In 1834 the British banned the slave trade. The subsequent process of emancipation was a long drawn out affair with implications for the local labor supply but with little impact for those areas further away from Cape Town.

Settler life outside the Colony did change substantially. In the 1830s approximately 6000 *Afrikaners* left the eastern Cape districts migrating into the as yet un-colonised interior of South Africa in a move known as the Great Trek. Politically, the result was the creation of three new settler territories: the British colony of Natal in the east and the two independent

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[5] *Trekboers* on the frontier were accustomed to arming themselves and forming small combat units that would either retrieve stolen cattle exacting retribution, or themselves maraud the neighboring kraals. These armed units were semi-formal institutions with recognized commanders in which the local settler population was obliged to serve.
[6] 'Old' because it was the frontier in the eighteenth century but which eventually closed as the region became more densely settled during the nineteenth century.

Boer republics in the north: The Republic of the Orange Free State (OFS) and the Zuid-Afrikaansche Republiek (ZAR).[7]

The economies in the two independent republics and in Natal remained small and dominated by livestock rearing, the largest problems being a shortage of land due to both the large size of the initial farms and the partible inheritance system. In terms of land quality, the further reaches of the Eastern Cape and Natal received higher levels of rainfall than the arid interior, we refer to these later colonized regions as New Frontier Arable. The demand for children was driven by the same factors as in the previous century, demand for labor and concerns about land and food availability (and possibly also love). One further factor may have played a role in child bearing decisions. In the east of the Cape Colony conflict over land with the neighboring Nguni tribes halted territorial expansion in that direction until the tribes were ultimately subdued (1866) and their western lands incorporated into the Cape Colony. Similar conflicts took place in Natal which the British subdued mid-century. The loss of land and cattle left these tribes with little choice but to enter the labor market in the farming community impacting labor supply.

The discovery of diamonds on the arid north western frontier of the Cape Colony in the 1860s and the subsequent growth of the mining industry appears to have had little initial impact on rural *Afrikaner* and English lifestyles. These people seem to have remained to a large extent disengaged from the mining sector (Davenport 2013). Indeed the growing mining industry was dominated by both foreign capital as well as immigrant workers. The discovery of diamonds did however lead to the inclusion of that region into the Cape Colony in 1880. We refer to the arid northern Cape as well as the ZAF and OFS as New Frontier Dry. While the northern Cape was certainly a low rainfall area, the name may be a misnomer for the ZAR and OFS, we wish merely to distinguish these regions from the newly colonized wetter regions of the south east.

Another crucial impact of the discovery of diamonds was the development of Port Elizabeth on the south east coast as an urban area and the growth of Cape Town as the center linking the diamond mining region to the rest of the world through its harbor. Simultaneously, as a result of settlement in Natal, the ZAR and OFS several towns were established in these regions: Durban, Pietermaritzburg, Bloemfontein, Pretoria, Potchefstroom, and later also Johannesburg. We refer to these younger urban areas as New Urban. Like Cape Town, population density in these

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[7] See Giliomee 2003 chapter 6 for more details.

areas was higher than in the countryside and labor requirements were substantially different to those in the rural areas. While fertility decisions based on space and labor needs may have been similar to those in Cape Town, distance from international markets implies any changes in preferences for children brought on by international trends or access to alternative consumption goods would reach these locations with a lag. Figure 1 shows the breakdown of South Africa into our six regions, two urban and four rural.

Two additional factors play a role in fertility decisions, children's education provision and women's opportunities outside the home. Under the VOC schools were established both by government and by churches in the more populous areas. In the less populated rural areas two or three families might get together and hire an itinerant teacher for half a year or so who was at most capable of teaching some rudimentary reading and writing (Malherbe 1925, p. 36). Under British rule the government at the Cape established schools in the most populous towns of each district where English was to be the medium of instruction (Malherbe, p. 58).

With regard to possible changes to the incentive for children because of changes to women's preferences, education in the colonies over the 200 year period did little to challenge the prevailing notion that a woman's place was in the home. Public education in its earliest form emerged in the 1830s with the opening of an infant school in Cape Town that took in children up to the age of eight. According to the institution's first annual report "the principal subjects brought before the children, in order to employ, amuse, and instruct them – [were] Spelling, Numbers, Grammar, Natural and Scripture History; – and for the Girls, Needle-work" (Ross, 2004 p. 89). The expectation was that girls were not being prepared for one of the professions, but for a life as a wife and mother. School attendance was also not compulsory. By 1877 approximately 60 % of school-age children in Natal were enrolled in school, 49 % in the Cape Colony, 12 % in the Orange Free State and 8 % in the Transvaal.

The discovery of gold in 1886 was to change the fortune of the South African economy. The scale of economic development that took place, particularly in Cape Town and Johannesburg, following the advent of large-scale gold mining transformed South Africa from a rural settlement colony into an urbanizing industrial one. By that time, we argue and show later, South Africa's settler fertility transition had already begun.

4. Data and transcription

This study will make use of South African Families (SAF) obtained from the Genealogical Institute of South Africa (GISA). These genealogical registers include records of all known families that settled in South Africa and their descendants. They contain vital information on over half a million individuals over a period of 200 years.[8] The registers were compiled by professional and amateur South African genealogists, from inter alia, baptism and marriage records of the Dutch Reformed Church archives in Cape Town, marriage documents of the courts of Cape Town, Graaff-Reinet, Tulbagh, Colesberg, collected from a card index in the Cape Archives Depot, death notices in the estate files of Cape Town and Bloemfontein, registers of the Reverends Archbell and Lindley, voortrekker baptismal register in the Dutch Reformed Church archive in Cape Town, marriage register of the magistrate of Potchefstroom, and other notable genealogical publications including: C.C. de Villiers (1894) "Geslacht-register der oude Kaapsche familiën", D. F. du Toit and T. Malherbe (1966) "The Family register of the South African nation", J.A.Heese (1971) "Die herkoms van die Afrikaner, 1657-1867", I. Mitford-Baberton (1968) "Some frontier families", and various other genealogies on individual families.[9]

The dataset contains information at the male individual-level including, where available, birth, baptism, marriage and death dates, occupation, geographic information for said events, and spousal information including birth, baptism, and death dates and places, as well as maiden names and parents' names. We limit the current analysis to marital fertility since children born out of wedlock were rarely recorded in any of the source documents used by the genealogists who compiled the family lineages. Since we identify women as spouses rather than as daughters we do not include women who did not marry within our sample.[10] We also do not include married women who had no recorded children because we cannot claim that he and his wife had no children. A couple may have had no offspring or the genealogists may have stopped following the lineage. We do however make an assumption that the number of these women is

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[8] Although the data contain all known families, they do not always contain all members of these families. We discuss the implications further on.

[9] Gouws (1987) and Cilliers and Fourie (2012) provide a more detailed description of the origin of the GISA data.

[10] This includes women who either never married or married a man who is not in the SAF data because his lineage has not been traced.

not more than the number of women with one child and add this number to our fertility calculations, this is necessary in order to make a comparison with other studies.

We begin our analysis with individuals born 1700 and after as a result of both the small population sample size for the period 1652-1699. To be included in the sample for this analysis, complete information must exist for the mother's birth date as well as the number of children she gave birth to during her fertile years.[11] Female reproductive life is taken to be between the ages of 15 and 49, which means for this sample, childbearing covered the period 1715 to 1959. We follow 23,484 women born between 1700 and 1909, who gave birth to a total of 130 776 children during their reproductive years.[12]

Figure 2 shows the SAF sample for which complete birth and death dates exist as a proportion of the total settler population. Note that while the full sample is far larger and may in fact come close to the full population we can only make a comparison to existing population estimates for individuals who can be accurately located in time. As this requires both a birth and death date, we are limited by the consistent under-reporting of death dates in SAF. Our sample size is approximately 30% of the total white population.[13]

Table 1 shows the proportions of the sample for which we have information on husband's ancestry, home language, woman's birth place, husband's occupation, and region of residence. The table breaks this information down into 50 year time intervals and includes the proportion of the sample for whom that particular variable is unknown. Our region measure uses the birth or baptism place of the first child or a couple's marriage place where a birth or baptism place is missing (Raper, 2004). There is a large amount of variation across the variables of the proportion of the sample with unknown information. Around one third of the husbands in our sample can trace their ancestry to the Netherlands, with France as the second most common country of origin. We see an increase in UK ancestry from the 1800s onwards which coincides with the switch in governance at the Cape and the arrival of large numbers of British settlers. The increase in the proportion of British settlers also coincides with an increase in the proportion of people speaking English in the Colony.

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[11] The Data Appendix discusses the dataset composition.

[12] The sample drops off around 1912, GISA hope to update those records in the future.

[13] The Data Appendix provides a comparison of the SAF sample with census data.

There is an increase over time in the proportion of women in the sample who were born in the Colony, reflecting the growth of the domestic population by natural means. The decline in the proportion of unknowns here also indicates an improvement in record keeping for the locally born population relative to the adult migrant population.

Husband's occupation has a fairly high proportion of unknowns, which follows from the type of records used to construct the data. Over 50% of our known sample were engaged in agricultural pursuits which is consistent with the occupational distribution of a pre-industrial society as well as with the frontier society of the Cape. This is also consistent with the region of residence variable which shows for the early years, the highest proportion of people for whom we have data, resided in the rural areas of Old Arable and Old Frontier which was dominated by farming activity. Over time as predominantly Afrikaans speaking settlers advanced beyond the borders of the Cape Colony, we see an increase in the proportion of people residing in the New categories where farming dominated in the two New Frontier regions. The underreporting of occupation is not a constraint as the analysis focuses on region and hence we can include those who do not report an occupation.

The increase in the sample beyond the Cape boundaries is encouraging in that it suggests a continuity of record keeping. Religion played an important role in the *Afrikaner* household, a consequence of which was the desire to baptize all children born in the family, thereby ensuring substantial records of birth but not always of death. Even the geographically isolated *trekboers* would meet several times a year at the nearest settlement for the *nagmaal*, a religious ceremony allowing these isolated families to socialize and where all new born children could be baptized. The result is that surviving children would have been baptized but those infants that died before the opportunity to baptize them are most likely under-reported. We acknowledge that there is likely to have been some decline in the quality of record keeping during initial settlement. We believe that the bias is likely to be towards large families who may also have been wealthier. The record keeping in these New regions is likely to have improved over time. These regions were not closed to the world and did engage in trade with the Cape. The continuous search for rich mineral deposits in the ZAR kept this region integrated even though it was poorly managed. There are unfortunately no censuses with which to compare our sample in this period.

5. Settler demographic characteristics

Figure 3, panels a - e, presents age-gender profile of the sample in fifty year intervals. The first half of the eighteenth century witnessed an extremely skewed distribution of both sexes (figure 3a). The VOC's hiring preference for single young males is reflected by the high proportion of young adult males relative to older males and teenagers. The proportion of women aged 20 and above is only 14% of all females in the sample. However, there is evidence of a natural increase in the population as shown by the high proportion of both males and females of very young ages. After 1750, the age distribution begins to balance out somewhat, taking on the distribution of a traditional pre-fertility transition society, that is, with a high proportion of children and decreasing proportions of successive age groups. The low percentages of both older adult males and females (figure 3b) may reflect short life expectancy, high childhood mortality, and high fertility.

By 1800 and 1850 (panels c and d), we see a pre-transition society with each successively younger age group representing a higher proportion of the sample. Mortality rates in 1800 appear higher than those in 1850 as shown by the hyperbolic slope of the distribution, particularly for males. The slope of the age distribution in 1900 is steeper than in previous years suggesting an overall decline in mortality for each age group. We also see an increase in the proportions of men and women living longer. While the proportions of children aged 0-5 are higher than any other age group in 1800 and 1850, by 1900 there is evidence of a decline in fertility with the proportions of children under age 10 falling substantially. Barring any substantial increases in child mortality, the fertility transition appears to be well under way by this stage.

6. Analysis

Parity characterization

Figure 4 provides the first ever complete series of married female parity for settler South Africa over the period 1700 - 1910. Average parity is slightly above seven for mothers born between 1700 and 1800 and declines by about a child for mothers born after 1800. Parity remains between six and seven children, gradually declining until mothers born in the 1850s. Thereafter we see a large dip in settler parity for women born from the 1860s who would have been having children from the late 1870s

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onwards with average parity for women born by 1900 of three and a half children. The trend in figure 4 suggests that a fertility transition was certainly under-way for the 1860s birth cohort. Later, we look in more detail at the data to try to pin dates down.

Table 2 provides a summary over time of the typical variables that have a bearing on fertility. The third column replicates the numbers from figure 4. The fifth column shows that the decline in parity is certainly not due to increases in mother's mortality. In fact, women born in the second half of the nineteenth century lived longer on avergae than their mothers a generation before. The slight increase in the age at marriage may well have to do with a shift in the gender balance as the Cape Colony became more established and the gender ratio equalized. Mother's age at first birth increases over time, as expected given the increase in age at marriage. There is, however, simultaneously an increase in the interval between marriage and first birth. The trends in marriage and first birth ages point to an intention to practice some form of birth control by delaying the beginning of childbearing. Further suggestions of explicit parity dependent fertility control come from a decline in mother's age at the birth of her last child. Combining age at first birth with age at last birth, we see a decline in the window of time during which women were having children. The final column of table 2 shows average birth intervals across all children. Birth intervals remain constant until women born in the 1870s. For this and later cohorts we see an increase in the average years between successive children, a further indication of some form of fertility control.

Table 3 breaks average parity by mother's birth cohort down by age at first child, last child, and death over our 200 year period. It is no surprise that over all cohorts, the earlier a woman started having children the more children she had on average, and the later she stopped having children, the more children she had. Furthermore, the longer she lived, the more children she had. Regardless of the age at first birth there is a slow yet steady decrease in average parity. The pace of decline appears to increase for women born in the 1850s, the youngest of whom would be having children by the late 1870s. This steeper decline continues with later cohorts. We see a similar pattern when looking at mother's age at last birth, a slow yet steady decline in average parity with the pace picking up in this case for women born by 1875. The final panel of Table 3 shows that for most life lengths, average parity was decreasing by successive birth cohorts with a notable drop for women born by 1850 and continuing for later cohorts.

Figure 5 shows annual fertility rates over time, that is the number of births per 1000 women of childbearing age in each year. It also includes a

lower bound on the fertility rate if we assume that the number of married childless women is the same as the number with one child. We start the series at 1800 to reduce the volatility evident throughout the 1700s due to small sample sizes. The early years of the 1800s continue what we find for the previous century, high volatility due to small sample size and a rate of between 200 and 240 children per 1000 women if we disregard the outlier years. An increase in sample size from the early 1800s reduces the variability within the series.[14] We see a decline in the number of children born per year per 1000 women between 1820 and 1840 followed by a stable fertility rate of around 190 children per 1000 women each year until a slow decline from about 1880. We stop the series in 1899 at the outbreak of the Boer War.

As a final look at the overall fertility pattern we use the Coale and Trusell (1974) marital fertility index, I_g since we have no information on the fertility of unmarried women. I_g is the number of births to married women in a year divided by the number of women in five year age intervals multiplied by the fertility rate that women in those five year age intervals could be expected to have if no fertility limiting behavior was taking place.[15] Our marital fertility index is fairly stable at around 0.45 until it begins a steady decline from 1870 onwards to end at 0.31 in 1900 (see figure B2).

Values of I_g less than 0.6 represent a population that controls fertility (Wetherell 2001, Cummins 2009). Thus, the settler population in South Africa appears to have been controlling its fertility already in the eighteenth century. This is in direct contrast with those scholars who argue that prior to the onset of the fertility transition across Europe in the late nineteenth century, very few populations were able to practice any sort of fertility control (Knodel 1977). Our result is rather along the lines of Carlsson (1966), Easterlin (1971), Craig (1991), Voigtlander and Voth (2013), Bengtsson and Dribe (2006), and Cinnirella et al. (2012) who argue that even prior to the onset of the fertility transition, there were groups of people already practicing fertility limitation. Coale and Trusell originally used I_g to time the start of fertility transitions. Using their rule of thumb that a 10% decline in I_g signals the onset of a fertility transition, we find that South Africa's settler fertility transition started in the 1880s. There is some debate about whether the index is able to accurately date the start of the transition

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[14] Appendix figure B1 depicts the number of women and children born per year in the sample.
[15] We use the corrected series for unlimited fertility in Wetherell (2001).

(Guinnane et al. 1994 and Wetherell 2001) and we by no means rely solely on this index.

We now turn to examine parities by the age of the mother. Figure 6 shows decadal birth cohort parities by mother's age-group from 1750 until 1900.[16] For all cohorts, parity is highest between ages 20 and 34, in particular between ages 25 and 29. The number of children a woman had at each age drops as women age across all cohorts. Women born in the 1850s have lower parities at younger ages than those born in the first decade of the 1800s but by the time they are older their parities have converged. Overall this would suggest a decline in total children born to the 1850s cohort. There is a clear decline at all ages in the number of children born to the 1860s cohort. This decline in parity continues monotonically over all the birth cohorts until we see little change between the 1890 and 1900 cohorts.

Another way to think about cohort parity is to see parity by age group over time as in figure 7. A vertical line raised from any of the years on the x-axis provides the same information given by the inverse u-shape for a cohort in figure 6. Although it appears that there is a decline in parity at some ages for the 1840s cohort, that appears to be merely a return to earlier parity levels. There is however an arguable decrease in parities at most ages for the 1850s cohort followed by rapid declines for women born in the 1860s aged between 20 and 39. The first evidence of fertility limitation by this 1860s cohort would be seen in the lower birth rates of the 1880s as shown in figure 5.

For confirmation of a decrease in period fertility in the 1880s we turn to figure 8 which shows period age specific fertility rates in the second half of the 1800s. The highest fertility rates are seen in 1850 and 1860, there is an arguable decline by 1870 and 1880 but the first clear decline is by 1885. The fertility rates of 1890 are also low, although not monotonically lower than in 1885 – we attribute this to annual variability. Finally, fertility rates are lowest across all except the eldest women by 1898.[17]

Characterization by sub-group

We break South Africa down into six regions that allow us to distinguish between urban and rural areas, areas of differing agricultural output and areas of early and late settlement. We also distinguish between

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[16] To improve legibility we exclude birth cohorts from the late 1700s and early 1800s where there is very little change.

[17] We use 1898 instead of 1900 to avoid the decrease in fertility due to the Boer War.

two language groups, whether a mother was born abroad or in South Africa to account for differences in culture, and four occupation groups to account for different relationships between socio-economic status and fertility.

In his discussion of the role of land accessibility on fertility, Easterlin (1971) divides the United States into regions of older settlement and newer settlement. This division translates very successfully into the South African context which was, during the time period we examine, a predominantly rural and agricultural economy.

Figure 9 panels a and b present average parity by mother's birth cohort for the six regions we look at.[18] The figure provides three dimensions of comparison. Firstly, it shows parity by timing of settlement; the Old Urban and Old Rural Arable regions are the only two to have parity data for mothers born 1700 - 1709. As the frontier expands we include data from Old Frontier, followed by New Frontier Dry. The last two series to enter the graph are New Urban and New Frontier Arable. Secondly, it shows parity across six different environmental conditions. Finally, it shows parity from the initial period of settlement until mothers born in 1910. We therefore compare parity by timing of settlement, by differences in agricultural conditions and, lastly, as it evolves over time. The figure shows that the three frontier areas exhibited their highest parities at their initial settlement, possibly because of the absence of land constraints and the immediate shortage of labor. These parities are however not statistically significantly different to later decades. If fertility decisions are based on the carrying capacity of the land which is in turn influenced by rainfall then we expect parity on the Arable frontier to be higher than on the Dry frontier which is indeed the case in the first half of the nineteenth century. The New Frontier Arable region has a parity level for mothers born in the 1830s comparable to the levels seen in the Old regions for mothers born in the 1790s. This observation is consistent with Easterlin's notion that the open frontier allows an expansion of family size in favorable conditions. We

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[18] The country is split as follows: Old Urban consists of Cape Town, Old Rural Arable consists of the districts of Stellenbosch, Drakenstein, Tulbagh, Malmesbury, Piketberg, Swellendam, Caledon, George, Uitenhage, Riversdal, Mosselbaai; Old Frontier consists of Graaff-Reinet, Cradock, Beaufort, Worcester, Somerset, Clanwilliam, Colesberg, Richmond and Albert. New Urban consists of Port Elizabeth, East London, Durban, Pietermaritzburg, Bloemfontein, Johannesburg, Pretoria and Potchefstroom. New Frontier Arable consists of Natal, the Eastern Cape that was not part of the Cape Colony in 1850, Albany, Stockenstroom, Fort Beaufort, Victoria, Peddie, and Bathurst. New Frontier Dry consists of the OFS, ZAR as well as the Northern Cape that was not already part of the Colony in 1850.

next consider parity over time. The four rural regions begin to experience a slow and consistent decrease in parity for women born from the 1850s onwards whereas average parity is at its highest for mothers born in the 1850s in the New Urban areas. Old Urban appears to have begun a decline in parity already for women born at the end of the eighteenth century. A universal and monotonic decline in parity is in place in all six regions for mothers born in the 1860s who would have been giving birth between 1880 until sometime during the First World War.[19]

Figure 10 shows average parity by age group for birth cohorts from 1750 – 1900 for Old Urban, Old Rural Arable and Old Frontier. A striking difference between these graphs is the older age at which women are most fertile in Cape Town and the older settled rural area, Old Rural Arable relative to women on the frontier prior to the onset of the fertility transition (ages 25-29 versus 20-24). Another is the higher parities for women residing in Old Rural Arable reflecting the greater carrying capacity of the land as well as possibly the greater need for labor given that these areas were more likely to grow crops. Both Cape Town and the Old Frontier have parities lower than Old Rural Arable, likely for different reasons. We see a peak in parity across all regions for the 1850 cohort followed by a decline in parity at all ages over time with the first large drop happening for the 1870s cohort although smaller declines can be seen prior to that cohort. In Old Frontier we see a shift over time from the most fertile age being 20-24 to 25-29 by the 1880s cohort.

Turning now to the New regions (figure 11), the data closely mirror the Old regions. For the early cohorts, women on the frontier experience highest fertility between the ages of 20-24, parities are higher in the rural areas than in the urban areas, and we arguably see a peak in parity for the 1850s cohort with subsequent declines in parity, with the greatest drop being for women born in the 1870s. With the drop in parity over cohorts we also see a shift for rural women from a most fertile age of 20-24 to 25-29 as we saw in the Old regions. After the fertility transition, parities are lowest in the New Urban towns. Tests of statistical significance (available on request) show that the two Urban areas have the lowest post transition parities, followed by New Rural Arable, then the New Frontier Dry and Old Frontier with Old Rural Arable having the highest parity after the start of the transition. Parities prior to the transition are not statistically significantly different. These six graphs suggest that the settler fertility

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[19] The appendix presents the regional parity breakdown with confidence intervals.

transition began with women born in the 1860s and picked up speed with the 1870s cohort.

We next look at differences in parity by language group (figure 12a). As discussed earlier, there are distinct cultural and regional differences between speakers of English and Afrikaans. Afrikaans speakers are the dominant settler group, with most English speakers arriving only after the Colony changed hands from the Netherlands to Britain. The SAF data do not record home language so we assign home language to all members of a lineage based on the country of origin of its progenitor (whether Dutch or British). If progenitor origin is missing, we assign home language based on first names (whether English or Afrikaans). In 11 % of the cases, language is unclear and we omit these observations from the analysis. The figure shows a very steady parity for Afrikaans speakers of just over 7.5 children per woman born in the 1700s declining to around 6.5 per woman born from 1800 – 1840. We then see a steady decline for subsequent cohorts of women to just under four children per woman born in 1900. English speaking women follow a similar trend although the pattern is more volatile due to fewer observations. The English series stabilizes for women born slightly before the mid-1800s due to the increase in the English speaking population at this time. While the number of children born to English speaking mothers is slightly above that of Afrikaans, the English parity decline occurs earlier, for women born in the 1840s than for Afrikaans and for women born in the 1900s, parity is just over three children.

Figure 12b suggests that women born outside of South Africa have higher parities than local born women but that this switches dramatically for women born in 1820 driven by a sharp decline in the parities of foreign born mothers, most likely as a result of increased immigration of British women. The parities of the foreign born cohorts essentially decrease through almost the entire period of observation. The parity of local born cohorts begins to decrease with the 1850 cohort.

In our final categorization we consider parity by the father's occupation (figure 13c). As noted earlier, only a small fraction of the observations contain information on father's occupation. The series are therefore extremely volatile with wide confidence intervals (not reported). Nevertheless patterns can be detected. The wives of white collar workers experience an initial decline in parity for women born in the early 1800s followed by a steeper decrease for women born in the 1860s. There is a case to be made that white collar families had the highest rates of parity for women born in the 1700s and lowest for women born in the early twentieth

century. There is a consistent decrease in parity for all occupation groups starting with women born in the 1860s. Because of the small sample size for this variable and the likely selection among those for whom we have information we do not probe this analysis further here.

Discussion of sub categories

All categorizations show a slight decline in parity in the first half of the 1800s followed by a substantial discernible decline for women born from the mid-1800s. While there are differences in parity rates across sub categories, all categories are in a fertility transition by the end of the data sample. Moreover, regardless of category, women born in the 1860s from all walks of life could expect to have fewer children than previous cohorts. Since we have only very limited information on childhood mortality we are unable to say anything about changes to this variable. However, as reflected in our age pyramid graphs in figure 3, we believe that what we see in the data is a fertility transition rather than a surprising increase in childhood mortality at a time when globally this rate was, if anything decreasing.

7.   International fertility rates and transition comparison

There are only a handful of fertility studies that use genealogical data such as ours and we therefore have a limited pool of studies with which we can compare our parity estimates. One landmark study by Bean et al. (1991) examines fertility over time in Utah. Like our study, they are able to look at fertility rates when the frontier is first opened and then as it begins to close. They calculate *mean children ever born* and find a parity rate of seven children per woman for women born 1800-1809. This increases for women born mid-century to eight and a half children for couples who only marry once and at least one child fewer for couples where either the husband or wife had more than one marriage. Parity begins to decline for women born from 1860 onwards across all types of marriage culminating in 4.9 children per woman for women born 1890-1899. While our data exhibit the same pattern over time, our average parity is lower than the Utah data by half a child to just over one full child for women born at the end of the nineteenth century.

Compared to the Canadian fertility rates in Gauvreau and Gossage (2001) of around 200 in 1851, which decline to just over 150 (Quebec) and close to 100 (Ontario) by the turn of the century, our marital fertility rates are around 200 in the mid-1800s. Recall that our sample omits married women who had no children and hence our fertility rates are artificially

high. Our fertility decline is however less steep, only reaching 150 by the turn of the century. Gee (1979) provides further fertility series for Canada and finds a fertility rate that is fairly similar to ours over the second half of the eighteenth century starting at 206 births per 1000 women to 133 at the end of the century (ours are 200 going down to 140 in 1899).

For Argentina, Pantelides (1983) finds crude birth rates in the late 1800s in the 40s, declining from the 1890s to 42.1 by 1910. In comparison we find a crude birth rate just over 10 points lower in 1875 and declining faster to 19.6 in 1910.

Caldwell and Ruzicka (1978) note that Australian women who bore most of their children in the 1850s, 60s and 70s averaged at least seven live births. These are women who would have been born between 1800 and 1850, where in our sample we find an average number of children of around six and a half with some variation (see table 2). Caldwell and Ruzicka claim that this relatively high rate of parity was due to early marriage in Australia which as table 2 shows was not the case in South Africa. Indeed, Australia's fertility rate mirrors that of South Africa in the eighteenth century where the South African gender ratios were closer to the Australian gender ratios of the first half of the eighteenth century.

Zodgekar (1980) finds a fertility rate of 300 in the 1880s for New Zealand, declining to 243 by the turn of the century for married women but also a substantial fertility rate for unmarried women. We therefore compare our data to his fertility series covering all women. He finds a fertility rate of 168 in the 1880s declining to 111 by 1903 which compares favorably to ours. Our data suggest lower fertility for settler South Africa (despite the omission of childless women) than these other settler societies. We note that other than the comparison with Bean et al. (1991) these differences may arise from differences in the types of data used.

We turn next to Europe, the origin of the South African settler community. Rothenbacher (2002, p. 23) lists crude birth rates for a number of European countries from 1850 to 1940. We start with the Netherlands as the country of origin for the majority of the settler population. The earliest recorded crude birth rate is 36.1 in 1870 declining to 31.6 in 1900. Ours is very similar at 34 in 1870 but declines somewhat faster, 20.0 by 1900.[20] The rates are again similar by 1930 at 23 for the Netherlands and 19 for South Africa. We next consider the United Kingdom, the colonial authority for most of the nineteenth century. The crude birth rate is 34 in 1870,

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[20] Figure B3 in the appendix.

declining to 28 in 1900 and 17 by 1930. Once again, our decline is faster but the rates converge by 1930.

The South African crude birth rate is comparable to many of the European countries prior to the onset of their fertility transitions but is considerably lower than all countries save for France by 1900. By 1930 the South African crude birth rate is around the median of European countries.

Finally, how does the timing of South Africa's fertility transition compare to other settler societies as well as to Europe? Moyle (2015) shows that marital fertility in Australia started falling steeply for women born in the 1850s. Bean at al. (1991) find a decline in fertility starting for women born in the 1860s. Indeed, although there is an argument for the early decline of marital fertility in the United States (Binion 2001), Hacker (2003) re-estimates white marital fertility and finds that the decline in marital fertility began as late as in the 1870s. He notes, in line with Easterlin (1971) that farmers in regions where new farmland was limited had begun to reduce their fertility accordingly, whereas on the frontier family sizes remained large advancing an argument for adaptation rather than innovation. Pool et al. (2007, p.61) similarly find a decrease in New Zealand fertility rates starting in the 1880s. Gee (1979) finds an early transition for Canada starting in the 1850s. Yet Gauvreau and Gossage (2001) suggest the Canadian transition started later (by the 1870s) and was not uniform across the country. It is evident then that settler fertility transitions, globally, started almost simultaneously. This includes South Africa which has at times been argued to be the poorest and most neglected settler region (Magee, Greyling and Verhoef 2016).

Cummins (2009) dates the start of the fertility transition in a number of European countries. He finds start years between 1874 (Belgium) and 1903 (Austria) with other European countries falling in between. These years compare well with South Africa where we argue the transition began in the 1880s for women born from the 1860s onwards. Of particular interest is a comparison of the South African transition with that of both Britain, the colonial master, and the Netherlands, perhaps the cultural master. Cummins finds a start date for the transition in England and Wales of 1877, comparable to South Africa's start. Van Bavel and Kok (2005) note that the fertility transition in the Netherlands began later than most European countries, in the 1890s, due to the influence of religion. Although dominated by Afrikaans speakers, South Africa's transition looks similar England's and that of other English speaking colonies, well before the Dutch start.

8. Concluding remarks

Our unique dataset which allows us to track women's fertility through their birth histories puts us in a strong position to add to the debate about whether societies practiced fertility limitation prior to the onset of fertility transitions. In this way we contribute to the discussion on the causes of the European and settler regions' fertility transitions. We see evidence of fertility limitation based on regional differences already prior to the onset of South Africa's settler fertility transition. This suggests that the fertility transition was not only the result of advances in birth control options but rather reflected changing use of already known fertility limitation techniques.

Estimates of completed fertility over time reveal that settler fertility was high and stable for the eighteenth and first half of the nineteenth century, with women having around seven children on average. In the space of the next 60 years, this number halved, with women born in the first decade of the twentieth century having only three and a half children on average. Differences in parity levels across different geographic areas prior to the transition reflect differences in the carrying capacity of the land, the availability of space, and the demand for labor.

South Africa's settler fertility transition can be dated as starting in the 1880s to women born from the 1850s onwards. The timing is very similar to most other settler societies and some of the early European transitions. South Africa's transition started earlier than some in Europe, in particular the Netherlands, the ancestral home of more than half of our sample. While we do not attempt to identify causes of the transition here, the timing of the transition is prior to the advent of industrialization and we argue therefore that the resultant large-scale structural change cannot be responsible for South Africa's transition.

9. Data Appendix

Genealogical Dataset

Since the original data are in text format, we created a novel data transcription program that converts the data from plain text into comma separated values, delineating the nature and timing of life-course events. In addition we translated any data that were in Afrikaans into English. We created unique individual, household, and mother identifier codes which allowed for the matching of offspring to both parents so that families can

be traced with relative ease over multiple generations. Genealogical codes were concatenated to unique individual identifiers indicating relative position in the lineage. For example, an a1 identifier-suffix indicates that an individual was the patriarch of the family or the 'first arriver' of that line to South Africa. If said individual had 2 children, their respective identifier-suffixes would be a1b1 and a1b2 respectively, and these siblings would share the same household identifier-suffix a1b. Women were assigned their husband's genealogical codes concatenated with an additional digit indicating whether they were a first, second, third or fourth wife.

The inclusion of spousal information was critical for enabling the linking of mothers to their children since the genealogical registers are recorded patrilineally (i.e. children appear in their father's household, and women appear as wives in their husband's households but are not directly linked to their own children. In cases where a man was only married once in his lifetime (94.5% of cases in our sample), matching mothers to their children is a relatively straightforward process using the individual and household identification codes that link individuals across and within generations. For these men, we match their wives to all of their husband's children. We count the number of siblings who share a family identifier and link them to their father (by simply removing the last digit of the family identifier code). Cases where men married more than once require us to carefully distinguish children belonging to the first wife from children belonging to the second, third, or in some rare cases, forth wife. An algorithm using the previous wife's death date, subsequent marriage date, and the birth dates of all of the children, allows for the matching of the correct children to the correct wife.[21] In the event that there was more than one wife and a birth or death date was missing, a successful match cannot be made.

The common problems associated with the use of genealogical data in historical demography research are already well documented (Hollingsworth 1968, Willigan and Lynch 1982, Zhoa 2001). They are biased towards the fertile and the marriageable since by definition a genealogy is the written record of a family descended from a common ancestor or ancestors, and as a result, most genealogies are the records of members of surviving patrilineages. These families most likely experienced favourable demographic conditions which resulted in their

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[21] Divorce was incredibly rare in this context and we assume that men remarried exclusively in the event of his wife's death.

survival. As a result, the use of these genealogies may not be representative of the history of the whole population in question (Zhoa, 2001 p. 181).

In a retrospective genealogy, such as SAF, it can be expected that each step backwards is associated with a risk of being unable to make a non-ambiguous link. This selection effect means that individuals in a retrospective genealogy in the 18th century are likely to be separated by fewer generations from the present than was really the case. This creates a bias towards long generations (late marriage, re-marriage, late child-bearing, high fertility) and long life. In general, however, the greater the number of generations recorded, the smaller is the impact of the selective bias, so long as the genealogy does not suffer severely from other types of under-registration. If the genealogy is shallow in generational depth or the members of the first few generations consist of a large part of the population being investigated, the selective biases are more likely to affect the outcome. Otherwise, their influences can be negligible. In our case, SAF benefits from great generational depth (see Table 1a) and the first few generations constitute a relatively small part of the population being investigated.

GISA asserts that the SAF registers are complete up until 1869 for all families and that they are only complete to 1930 for families with surnames starting with letters A-L. While the size and scope of the SAF data are its greatest advantage, not all entries contain complete information. Of the full data-set, which currently records over 670 000 individuals, many entries are empty save for a name and surname.[22] Close to two thirds of the entries contain a birth or a baptism date, while only one quarter contains a death date, and less than one fifth contains a marriage year. Table 2a presents this information. This calls into question the representativeness of the registers.

Census comparisons

We provide a description of the sample and a comparison to various Cape censuses where possible. Table 3a compares the age profile of the 1875 and 1904 censuses with that of the sample for people alive in the sample and for whom we have complete information in 1875 and 1904 respectively. [23] We see that the distribution of males and females in the

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[22] The dataset is subject to constant revision as GISA attempts to produce more complete family trees.

[23] The census of 1865 does not provide a breakdown of gender and age by race that would allow for a suitable comparison to our sample. Additionally, no official censuses

SAF data closely mirrors the proportions reported in the censuses for every age group. We further break the age comparison down by district and compare to the 1875 and 1891 censuses, this is shown in figure 1A. The figure compares the percentage of districts inhabitants under the age of 20 in 1875 and under the age of 40 in 1891. Our sample does not appear to reflect the Census very well, only for a handful of the districts is our estimate close to that of the Census. Figure 2A compares the gender ratios in the SAF and 1875 and 1891 censuses. In this case, the SAF appears to replicate the Census fairly well. We therefore do not believe that the SAF systematically under- or over-samples certain groups of the population with respect to gender, and likewise appears to provide an accurate representation of the age structure of the full population if not by district.

Next we consider the socio-economic structure of the sample, as proxied by the occupation of the household headfootnoteHusband's occupation was chosen here due to the fact that women rarely had reported occupations in both the genealogical data as well as in the censuses.Because of the nature of the source materials (by and large marriage certificates) used by the genealogists to obtain individuals' occupations did not always mandate that occupations be recorded, occupation is only reported for between 20 and 30% of the sample. It is possible that the more educated or only those with higher earning occupations noted their occupation and we would therefore have a biased record of the development of socio-economic status over time. We again provide a comparison with the available census documents. As a result of some inconsistency in enumeration of certain occupations in the censuses over time, we re-categorize reported occupations into four broad skill groups: i) white-collar workers, ii) farmers iii) skilled and semi-skilled workers, and iv) unskilled labourers, for simplicity. Table 4a shows that are some differences between the occupations reported in the SAF and those in the censuses. The mid-century comparison suggests that SAF underreports white collar workers, over reports farmers and provides a reliable comparison of skilled/semi-skilled and unskilled workers. At the turn of the twentieth century, SAF seems to slightly over report white collar workers, underreport skilled and semi-skilled workers and to provide a reliable comparison of farmers and unskilled workers. In particular, the SAF seems to underreport the number of skilled workers while

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were taken prior to 1865 against which similar comparisons could be drawn for the earliest period under investigation.

overreporting the number of white collar workers in the 1900 sample. The SAF data show an amount of socio economic mobility that is not reflected in the census. We do not postulate an explanation for this discrepancy and we do acknowledge that there is an amount of bias in the recording of occupation. However, since the analysis does not predominantly rely on this variable and since this variable is poorly recorded in the data and is only available for between 20 – 30 % of the observations, we do not consider this bias as compromising our analysis.

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Table 1: Sample proportions

	1700-49	1750-99	1800-49	1850-99	1900-09
Husband's ancestry					
Netherlands	0.32	0.32	0.32	0.29	0.25
France	0.26	0.22	0.18	0.14	0.10
Germany	0.06	0.10	0.10	0.09	0.07
UK	0.00	0.00	0.06	0.09	0.13
Other Europe	0.03	0.03	0.03	0.02	0.03
Unknown	0.31	0.32	0.31	0.37	0.43
Home language					
English	0.08	0.09	0.16	0.18	0.22
Afrikaans	0.85	0.84	0.77	0.74	0.66
Unknown	0.06	0.06	0.07	0.08	0.12
Woman's birth place					
Born locally	0.20	0.25	0.44	0.43	0.41
Born abroad	0.00	0.00	0.01	0.01	0.02
Unknown	0.80	0.75	0.55	0.56	0.57
Husband's occupation					
White collar	0.04	0.05	0.05	0.07	0.10
Farmer	0.16	0.14	0.17	0.18	0.12
Skilled/semi-skilled	0.01	0.01	0.03	0.02	0.01
Unskilled	0.02	0.01	0.03	0.02	0.01
Unknown	0.78	0.79	0.72	0.71	0.74
Region					
Cape Urban	0.08	0.12	0.04	0.02	0.03
Old Rural Arable	0.42	0.41	0.30	0.14	0.09
Old Frontier	0.01	0.17	0.27	0.14	0.07
New Urban	0.00	0.00	0.02	0.03	0.07
New Frontier Arable	0.00	0.00	0.03	0.06	0.04
New Frontier Dry	0.00	0.00	0.07	0.17	0.21
Unknown	0.50	0.30	0.28	0.43	0.49
Observations	477	2604	8621	17953	3759

Years represent year of birth of the father or mother

Table 2: Mother's characteristics by birth cohort

Cohort	n	Average parity		Life length		Marriage age*		Age at first birth	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
1700	43	6.9	3.9	56.2	18.4	21.8	5.1	22.2	5.5
1710	65	6.6	3.3	52.9	19.8	21.9	5.3	23.1	6.3
1720	109	7.3	3.3	58.3	20.8	22.0	6.9	23.1	5.3
1730	108	7.6	3.7	57.4	22.8	20.2	4.5	21.7	4.5
1740	152	7.4	3.4	61.2	18.5	21.2	6.1	22.3	5.3
1750	270	7.2	4.0	59.5	21.7	21.4	6.2	22.8	6.3
1760	338	7.1	3.9	61.9	17.8	20.8	5.2	22.2	5.0
1770	476	7.3	3.7	62.1	18.0	20.1	4.8	21.6	5.2
1780	636	7.4	3.8	63.2	16.7	19.9	4.8	21.4	4.9
1790	884	7.3	3.6	61.8	16.8	19.7	4.5	21.0	4.6
1800	1053	6.6	3.7	60.4	18.6	19.9	5.0	21.3	5.1
1810	1431	6.3	3.7	58.6	19.2	20.1	4.7	21.8	5.0
1820	1655	6.6	3.9	59.3	18.5	20.2	5.0	21.8	5.3
1830	1900	6.5	3.8	60.2	18.9	20.4	4.9	22.0	5.2
1840	2582	6.4	3.8	60.9	19.1	20.3	4.8	22.0	5.2
1850	3002	6.1	3.6	62.5	19.7	20.5	4.5	22.3	4.9
1860	3413	5.5	3.4	64.3	19.7	20.8	4.6	22.9	5.2
1870	3601	4.7	3.1	65.9	19.7	21.6	4.7	23.7	5.4
1880	3908	4.2	2.7	67.7	18.4	22.6	5.0	24.8	5.4
1890	4029	3.7	2.5	69.6	17.6	23.4	4.8	25.1	5.1
1900	3458	3.5	2.2	70.1	16.6	23.4	5.4	25.0	5.2

*First marriage only.

Table 2: Mother's characteristics by birth cohort, continued

Cohort	n	Age at last birth Mean	SD	Fertile years Mean	SD	First birth interval* Mean	SD	All birth intervals** Mean	SD
1700	43	34.1	7.9	14.7	8.5	3.1	5.3	2.4	1.6
1710	65	36.6	7.4	15.3	7.5	1.9	3.3	2.5	1.3
1720	109	36.2	7.2	14.9	7.3	1.4	1.1	2.3	1.3
1730	108	35.9	8.2	16.6	7.2	2.2	2.8	2.3	1.2
1740	152	37.3	6.9	17.0	7.2	1.6	1.3	2.6	1.9
1750	270	36.4	7.5	16.0	7.6	1.8	1.7	2.4	1.5
1760	338	36.2	7.0	15.8	7.8	2.1	2.4	2.6	2.0
1770	476	36.6	7.6	16.5	7.7	2.0	2.5	2.6	1.8
1780	636	36.1	7.5	16.3	7.4	2.1	2.8	2.5	1.6
1790	884	35.9	7.2	16.3	7.4	1.9	2.3	2.6	1.6
1800	1053	34.6	7.7	15.1	7.6	1.9	2.4	2.6	1.8
1810	1431	34.7	8.2	14.6	7.8	2.1	2.6	2.6	1.6
1820	1655	35.4	7.9	15.7	7.7	2.2	3.2	2.6	1.8
1830	1900	35.6	7.7	15.3	7.3	2.0	2.4	2.5	1.8
1840	2582	35.5	7.7	15.1	7.5	2.1	2.9	2.6	1.8
1850	3002	35.1	7.6	14.6	7.2	2.0	2.8	2.6	1.8
1860	3413	34.8	7.3	13.6	7.0	2.2	3.1	2.7	1.9
1870	3601	34.2	7.4	12.3	7.0	2.0	2.6	2.9	2.2
1880	3908	34.5	6.8	11.6	6.5	2.1	2.7	3.1	2.2
1890	4029	33.7	6.5	10.6	6.2	2.3	2.9	3.3	2.4
1900	3458	33.6	6.4	10.4	6.0	2.3	2.8	3.6	2.6

*Duration in years between date of marriage and the birth of the first child. **Inter-birth intervals for second and higher-order births. Years represent mother's birth decade.

Table 3: Average parity over time by age at which mother had first child, last child and by length of mother's life

Mother's age at first birth	1700	1725	1750	1775	1800	1825	1850	1875	1900
15-19	8.00	8.52	8.44	8.33	7.53	7.70	6.83	5.53	4.83
20-24	6.82	7.30	7.24	7.17	6.57	6.79	6.04	4.69	3.97
25-29	6.14	6.65	6.19	6.24	5.41	5.33	4.60	3.55	3.04
30-34	5.33	3.57	3.04	2.92	2.75	2.53	2.27	1.99	1.85
35-39	-	7.00	2.67	6.00	5.14	2.67	2.33	1.71	1.56
Mother's age at last birth	**1700**	**1725**	**1750**	**1775**	**1800**	**1825**	**1850**	**1875**	**1900**
15-19	2.00	1.71	1.19	1.56	1.48	1.62	1.43	1.56	1.23
20-24	2.57	2.40	2.21	2.38	2.20	2.10	2.02	1.81	1.74
25-29	3.74	4.04	3.65	4.04	3.78	3.71	3.33	2.51	2.36
30-34	7.35	7.29	7.41	7.65	7.02	6.81	6.11	4.57	3.89
35-39	8.94	9.80	9.85	10.39	10.16	9.63	8.96	6.92	5.92
Mother's life length	**1700**	**1725**	**1750**	**1775**	**1800**	**1825**	**1850**	**1875**	**1900**
15-24	1.50	2.50	2.00	2.00	1.73	1.75	1.63	1.71	1.50
25-34	4.50	3.80	3.63	3.56	3.86	4.24	3.65	2.90	2.48
35-44	6.27	6.71	6.11	7.00	6.20	6.34	5.82	4.38	3.36
45-54	6.50	8.19	7.55	7.45	7.19	7.42	5.65	4.19	3.17
55-64	9.14	7.00	7.66	7.35	7.20	7.29	5.84	4.25	3.65
65-74	7.07	9.06	7.53	8.19	7.63	7.57	6.33	4.32	3.55
>75	6.83	8.68	6.92	8.15	7.63	7.89	6.32	4.30	3.68

Includes only women with complete birth histories. Includes all women in the sample in those age groups in those years. Sample sizes and standard deviations available on request.

Figure 1: Map of South Africa with breakdown of regions

Old Urban consists of Cape Town, Old Rural Arable consists of the districts of Stellenbosch, Drakenstein, Tulbagh, Malmesbury, Piketberg, Swellendam, Caledon, George, Uitenhage, Riversdal, Mosselbaai; Old Frontier consists of Graaff-Reinet, Cradock, Beaufort, Worcester, Somerset, Clanwilliam, Colesberg, Richmond and Albert. New Urban consists of Port Elizabeth, East London, Durban, Pietermaritzburg, Bloemfontein, Johannesburg, Pretoria and Potchefstroom. New Frontier Arable consists of Natal, the Eastern Cape that was not part of the Cape Colony in 1850, Albany, Stockenstroom, Fort Beaufort, Victoria, Peddie, and Bathurst. New Frontier Dry consists of the OFS, ZAR as well as the Northern Cape that was not already part of the Colony in 1850.

Figure 2: Sample as a proportion of the total settler population
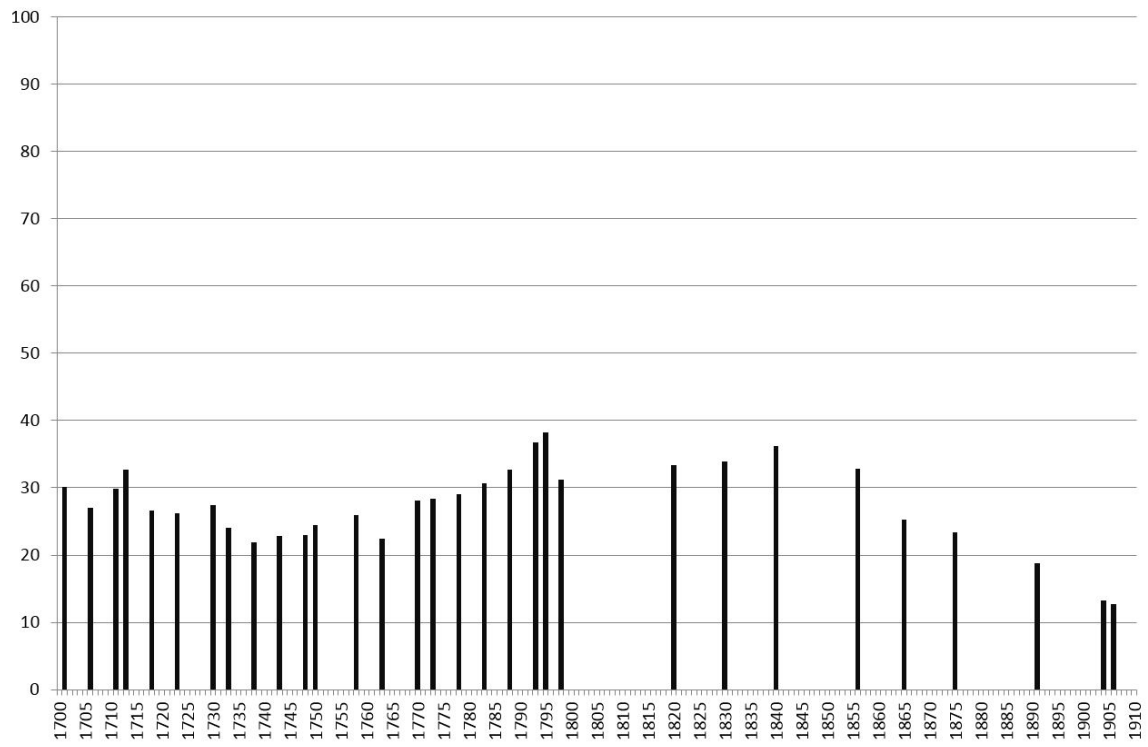
Source: SAF and Elphick and Giliomee (1989); Ross (1975); Statistical Records of the Cape Colony (1856, 1865, 1891, 1904, 1906); Sadie (2000)

Figure 3: Gender-age pyramid of the sample, individuals born 1700 - 1900
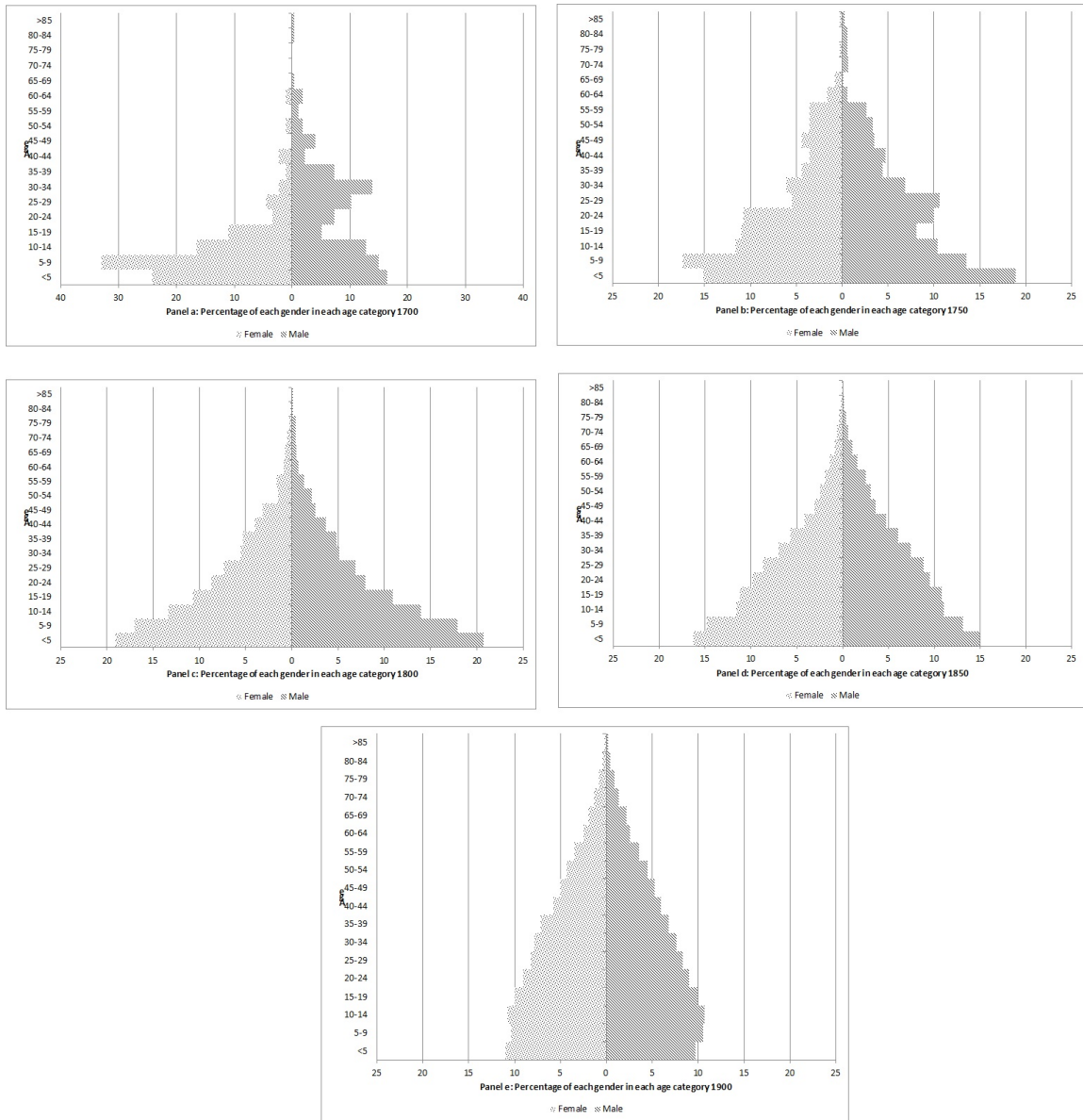
Figure 4: Average parity by mother's birth cohort, with 95% confidence bands
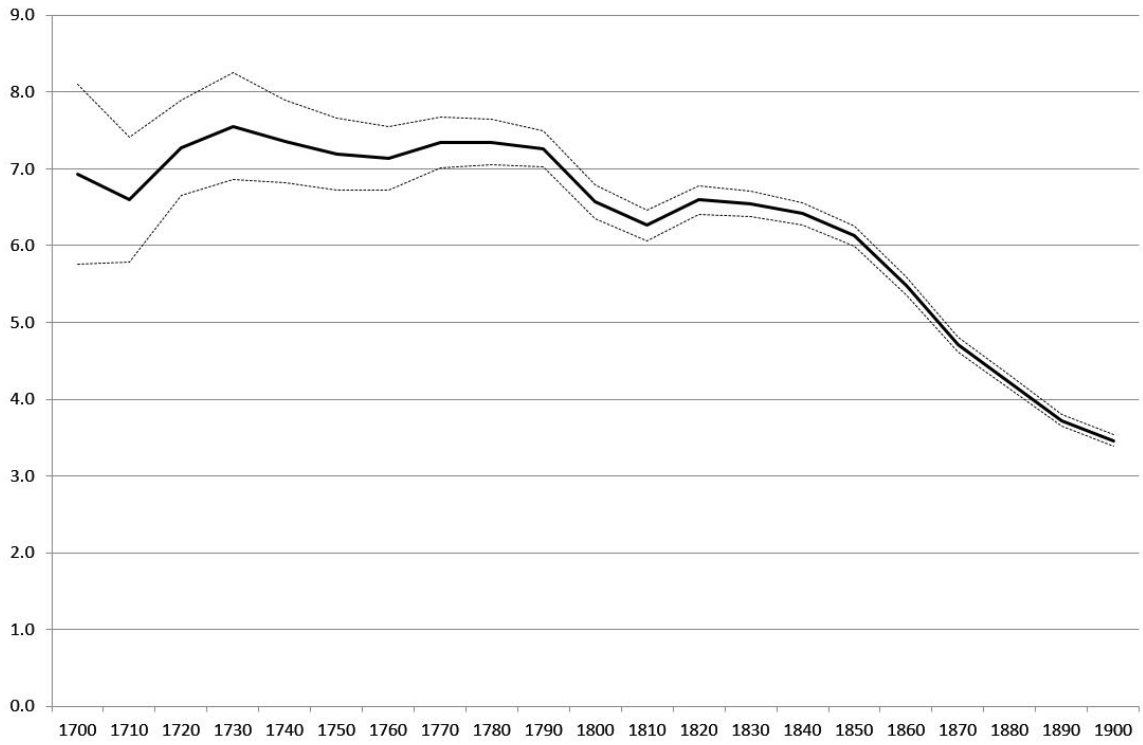
Figure 5: Fertility: annual births per 1000 women between the ages of 15-49
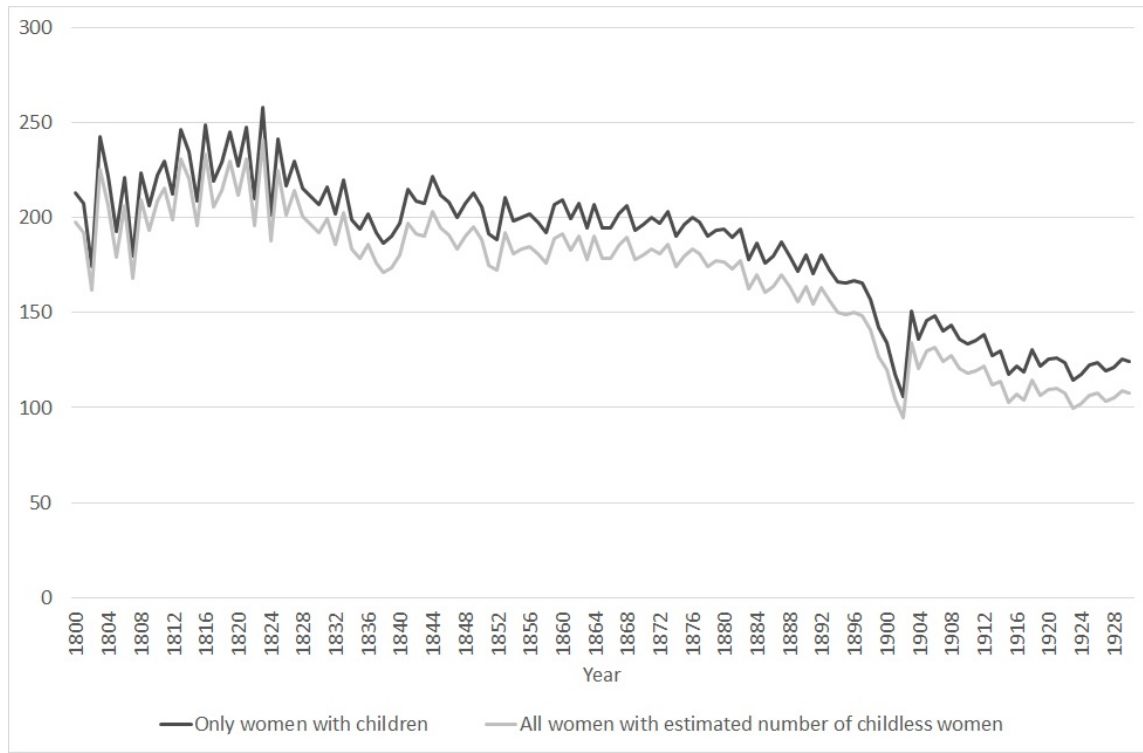
Number of childless women assumed to be not more than number of women with one child.

Figure 6: Cohort Age-specific parity rates
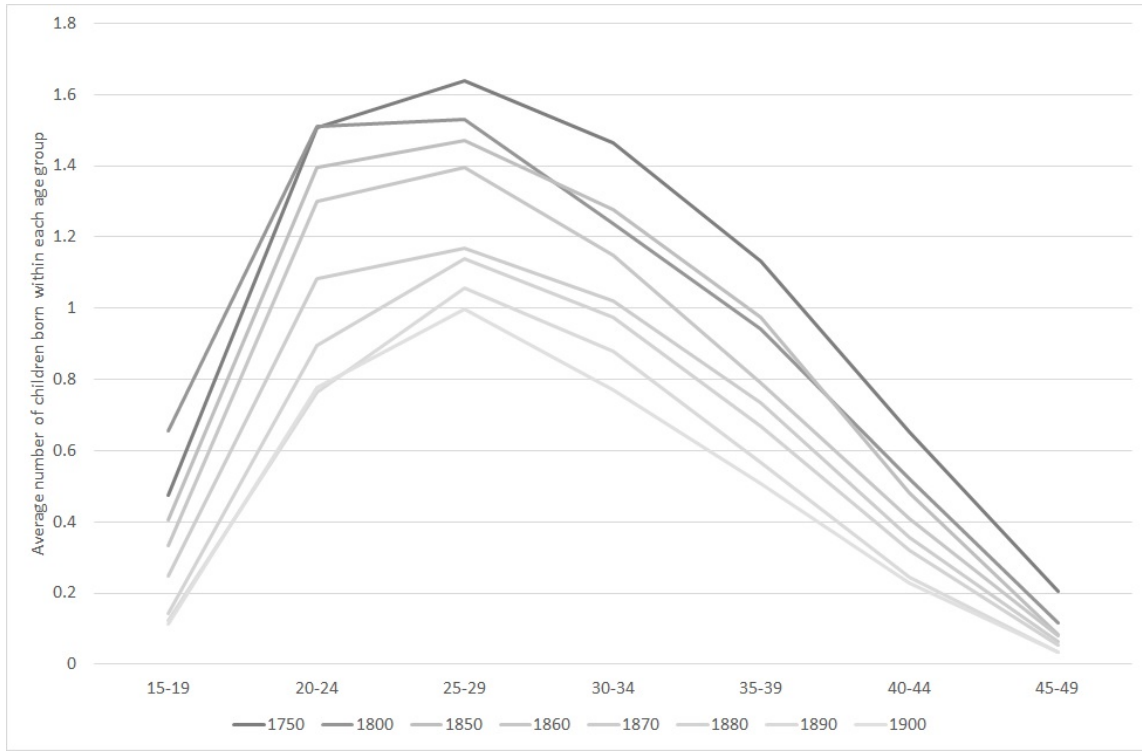
Figure 7: Age specific parity over time
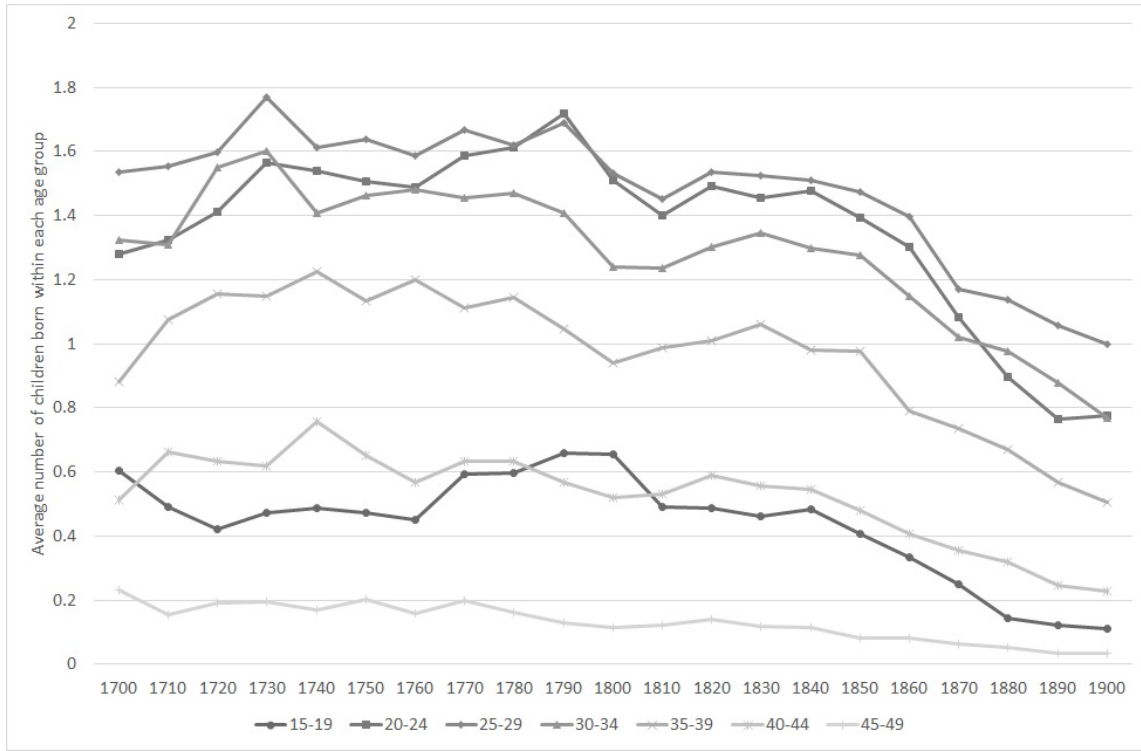
Figure 8: Age-specific fertility rates in the late 1800s
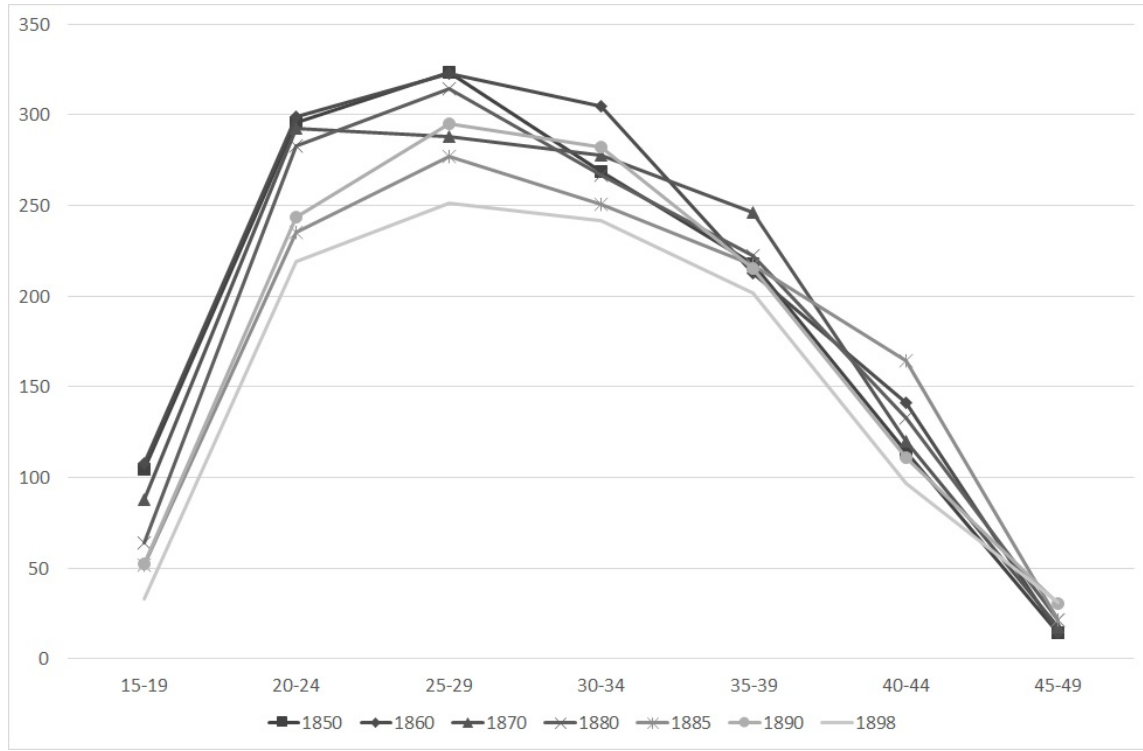
Figure 9: Parity by region
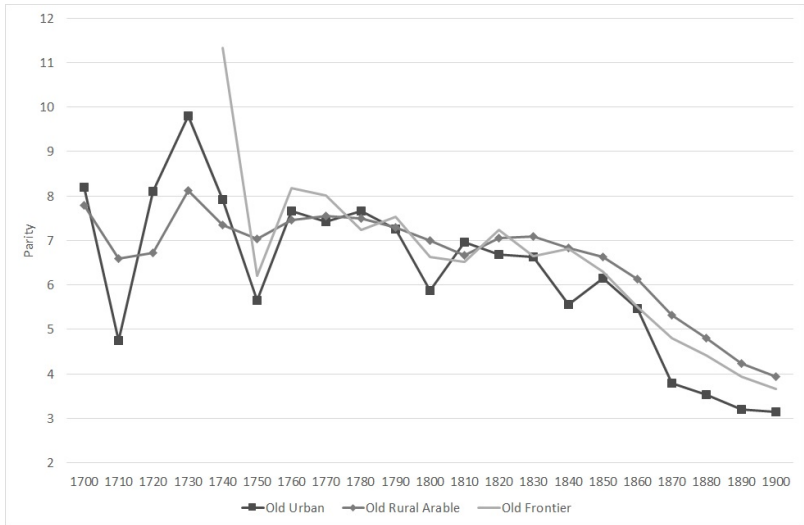
(a) Early Settled Regions
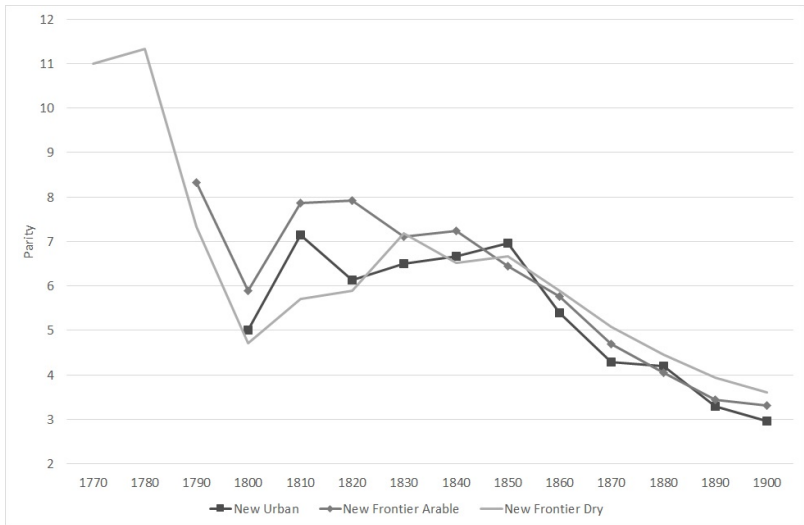
(b) Late Settled Regions

Figure 10: Age-specific parity in Early Settled Regions
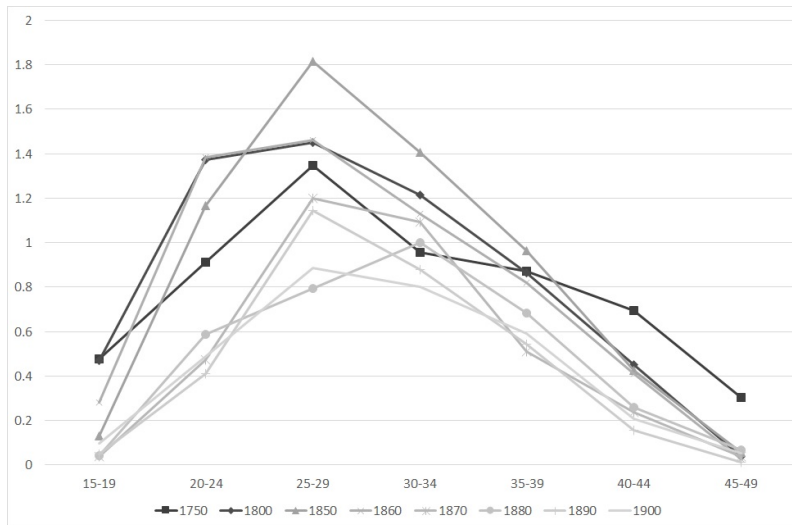
(a) Old Urban
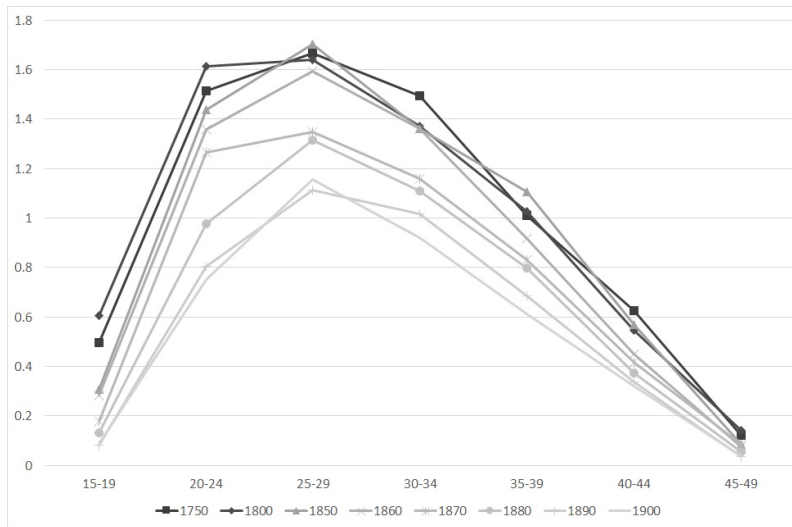
(b) Old Rural Arable
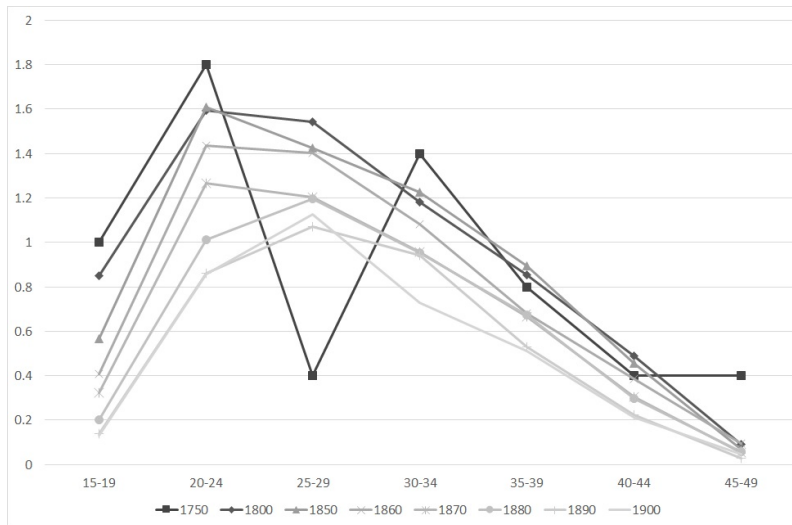
(c) Old Frontier

Figure 11: Age-specific parity in Late Settled Regions
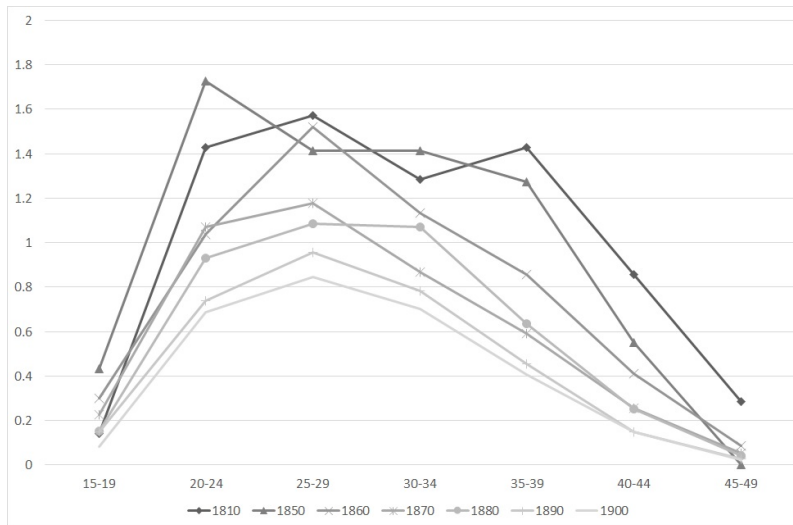
(a) New Urban
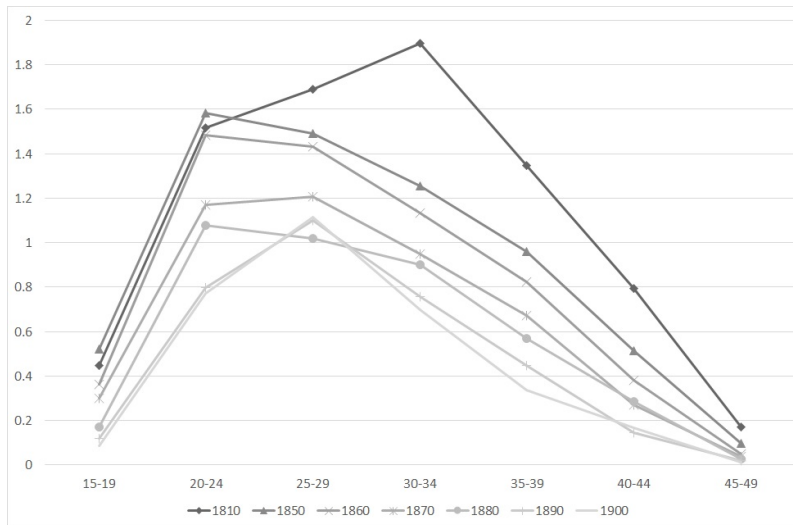
(b) New Frontier Arable
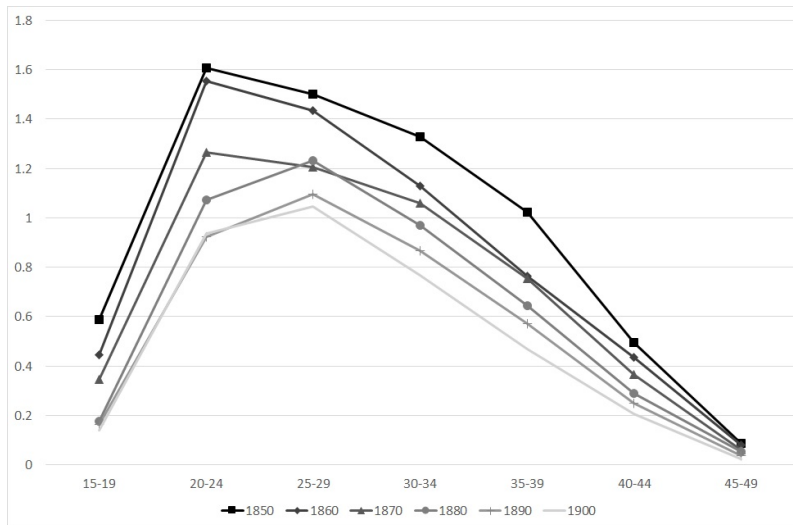
(c) New Frontier Dry

Figure 12: Sub-group Parity
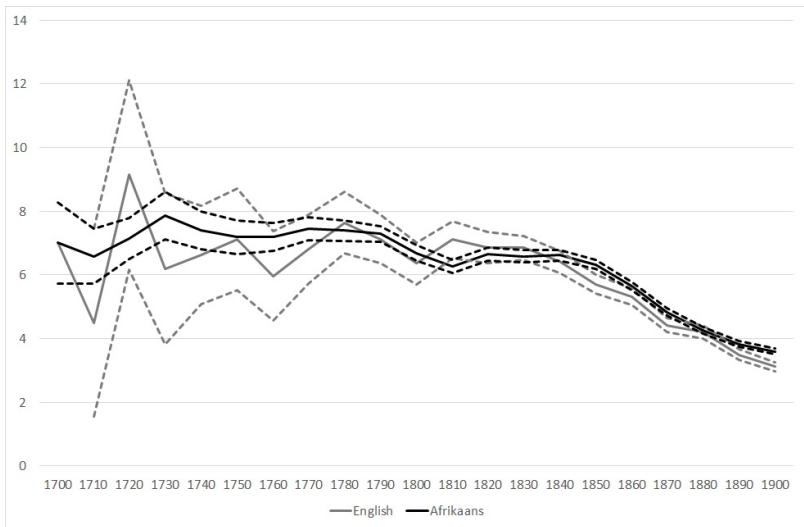
(a) Language
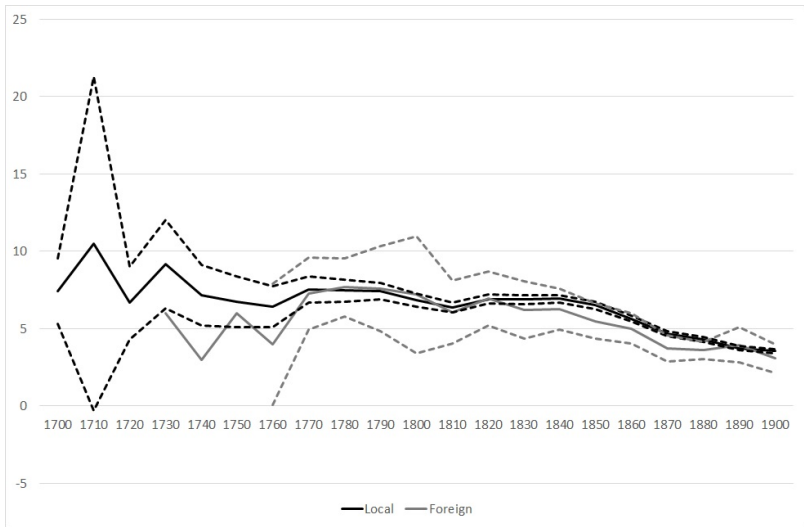
(b) Mother's origin
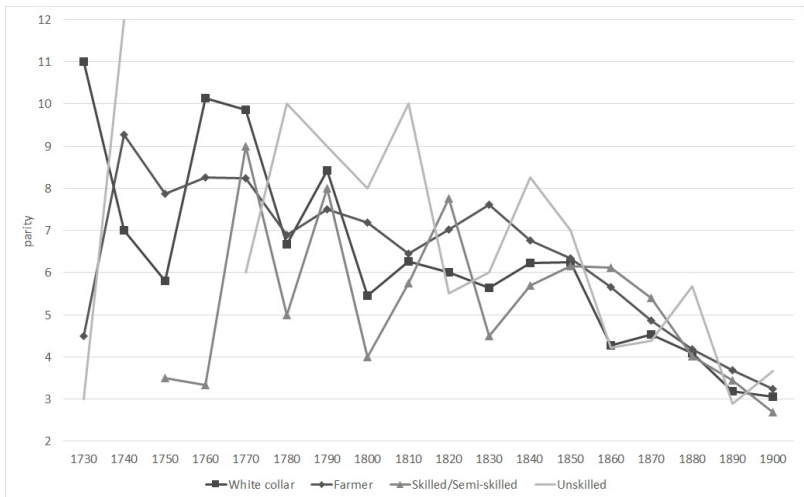
(c) Father's occupation

Table A.1: Distribution of individuals across generations

Generation	Frequency	% of sample
1	33,295	4.96
2	67,114	10.00
3	58,804	8.76
4	68,661	10.23
5	85,307	12.71
6	109,675	16.34
7	124,518	18.55
8	82,876	12.34
9	31,871	4.75
10	7,824	1.17
11	1,245	0.19
12	168	0.03
13	12	0.01
Total	671,385	100

Table A.2: Number of observations in the dataset for selected variables

Variable	Female	Male	N/A*	Total
Individual ID	305,260	360,936	5,189	671,385
Date of birth/baptism	219,089	255,902	2,029	477,020
Date of death	40,978	98,894	459	140,331
Date of first marriage	67,602	94,115	119	161,836
Age at first marriage	57,213	77,434	67	134,714
Age at death	35,720	82,563	317	118,600

*Sex of individual unavailable/unable to be determined from original records

Table A.3: Sample gender-age profile comparison with available censuses

Age	1875 SAF		1875 census		1904 SAF		1904 census	
	Males	Females	Males	Females	Males	Females	Males	Females
0-4	15.0	16.3	15.5	16.6	9.8	11.0	11.7	14.0
5-9	13.2	14.8	14.3	15.6	10.5	10.4	11.0	13.0
10-14	11.0	11.6	12.5	13.5	10.7	10.8	10.6	12.4
15-19	10.8	11.2	10.2	11.3	10.0	10.0	9.6	10.8
20-24	9.5	9.8	9.8	9.6	9.1	9.1	12.4	10.0
25-29	8.9	8.7	7.9	7.3	8.3	8.3	11.2	8.7
30-34	7.5	7.0	6.8	6.1	7.7	7.8	8.6	7.3
35-39	6.1	5.7	5.3	4.7	6.8	7.1	9.8	6.0
40-44	4.8	4.2	4.7	3.9	6.0	5.8	5.2	4.7
45-49	3.6	3.0	3.7	3.2	5.3	5.0	4.0	3.6
50-54	3.1	2.4	3.3	2.7	4.5	4.3	3.1	3.0
55-59	2.5	1.9	2.1	1.9	3.6	3.4	2.0	2.1
60-64	1.7	1.4	1.6	1.5	2.6	2.4	1.6	1.7
65-69	1.1	0.9	0.9	0.8	2.2	1.9	1.0	1.1
70-74	0.6	0.6	0.6	0.5	1.4	1.3	0.7	0.7
75-79	0.4	0.4	0.3	0.3	0.9	0.8	0.4	0.4
80-84	0.1	0.2	0.2	0.2	0.5	0.4	0.2	0.2
>85	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1

Source: Census of the colony of the Cape of Good Hope. March 1975 and 1904. Own calculations.

Table A.4: Sample proportion socio-economic status comparison with available censuses
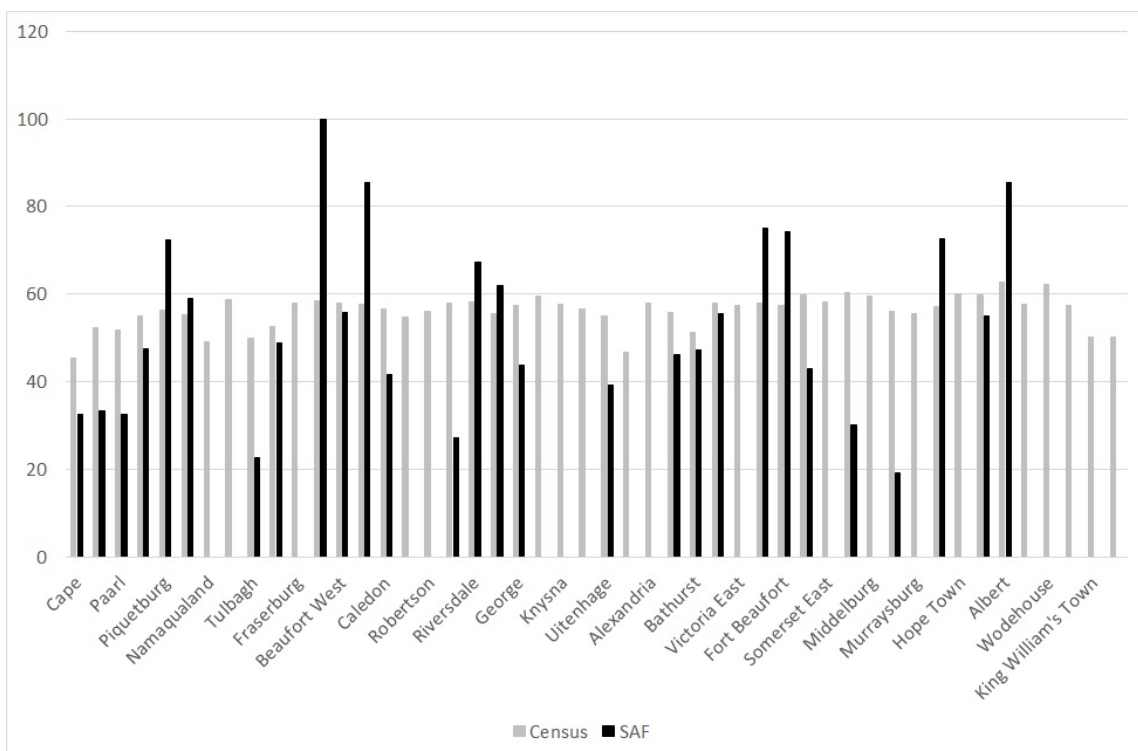
Household head SES	1850 SAF	1865 census	1900 SAF	1911 census
White collar	20.5	29.7	33.4	29.3
Farmer	64.4	55.3	49.8	47.8
Skilled/semi-skilled	8.4	7.5	13.9	19.0
Unskilled	6.8	7.5	3.0	3.8

Source: Census of the colony of the Cape of Good Hope. March 1965 and 1911. Own calculations.
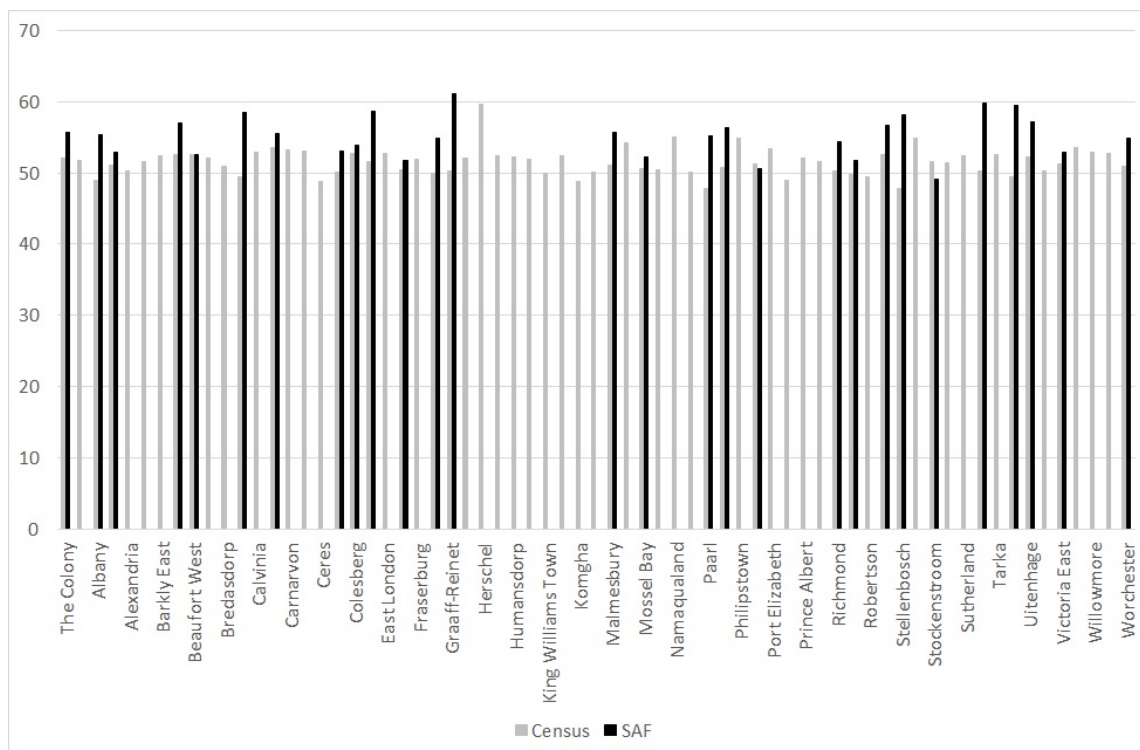
Figure A.1: Age and gender comparison with 1875 Census
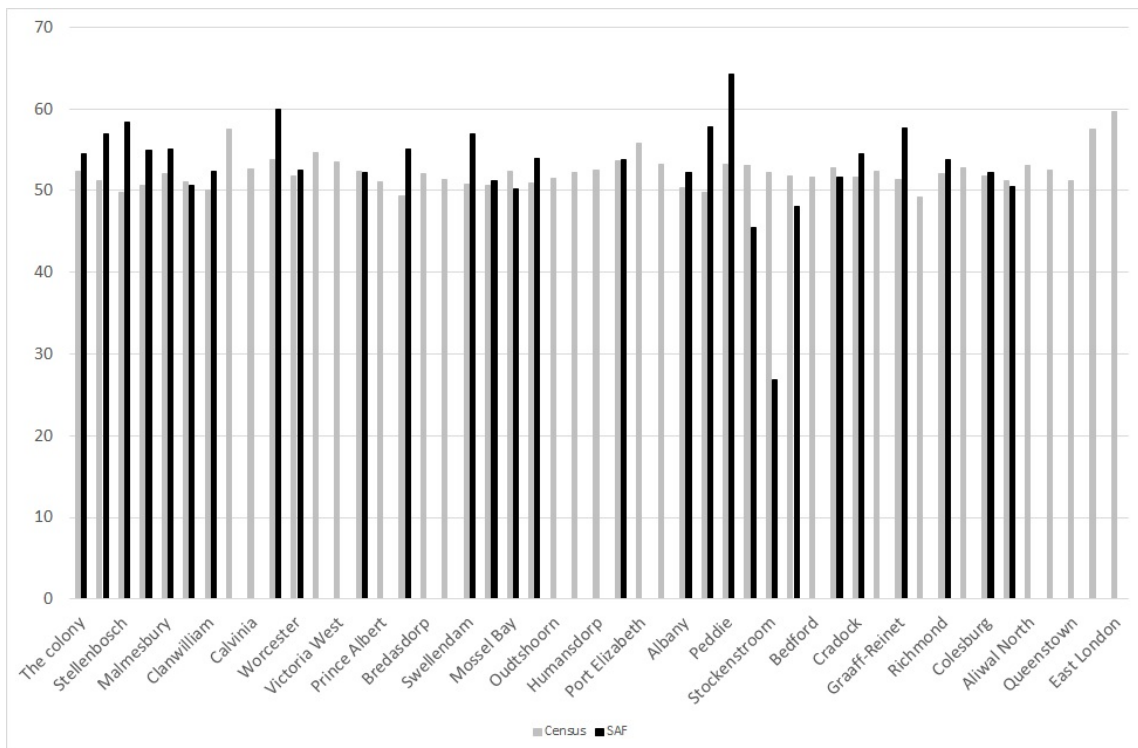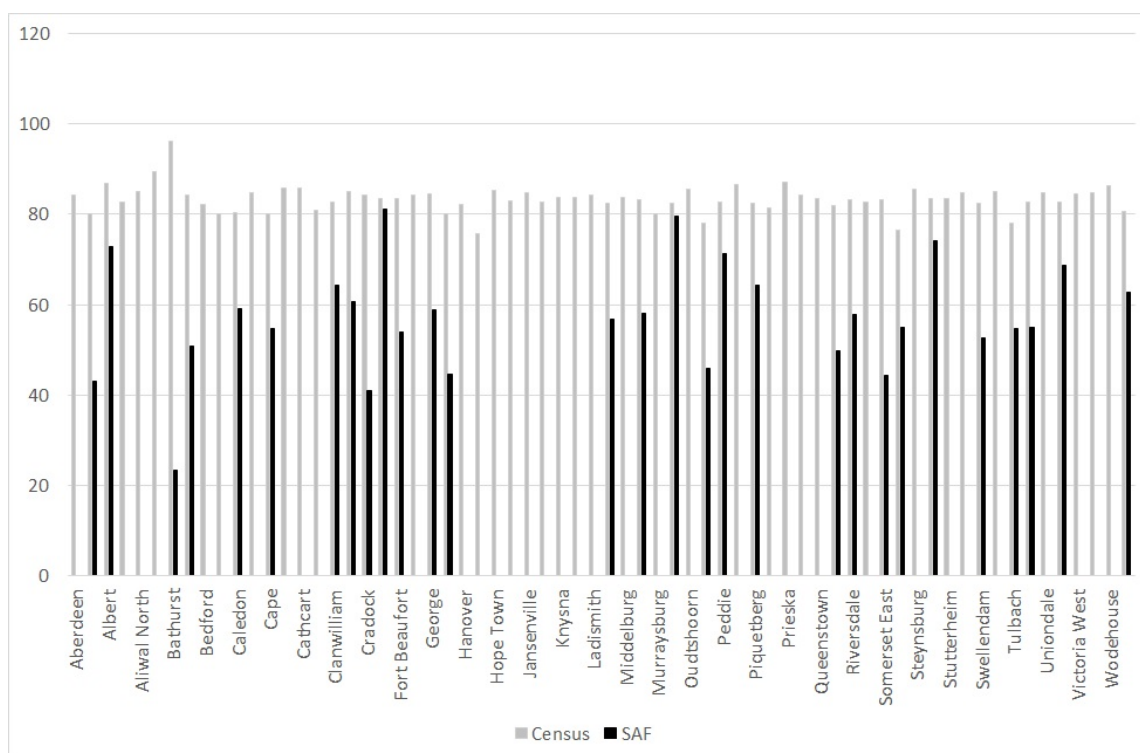

(a) Gender

(b) Percentage below age 20

Figure A.2: Age and gender comparison with 1891 Census

(a) Gender

(b) Percentage below age 40

Appendix B. Additional graphs

Figure B.1: Total number of women in each year with total number of children born in each year from 1720 - 1930
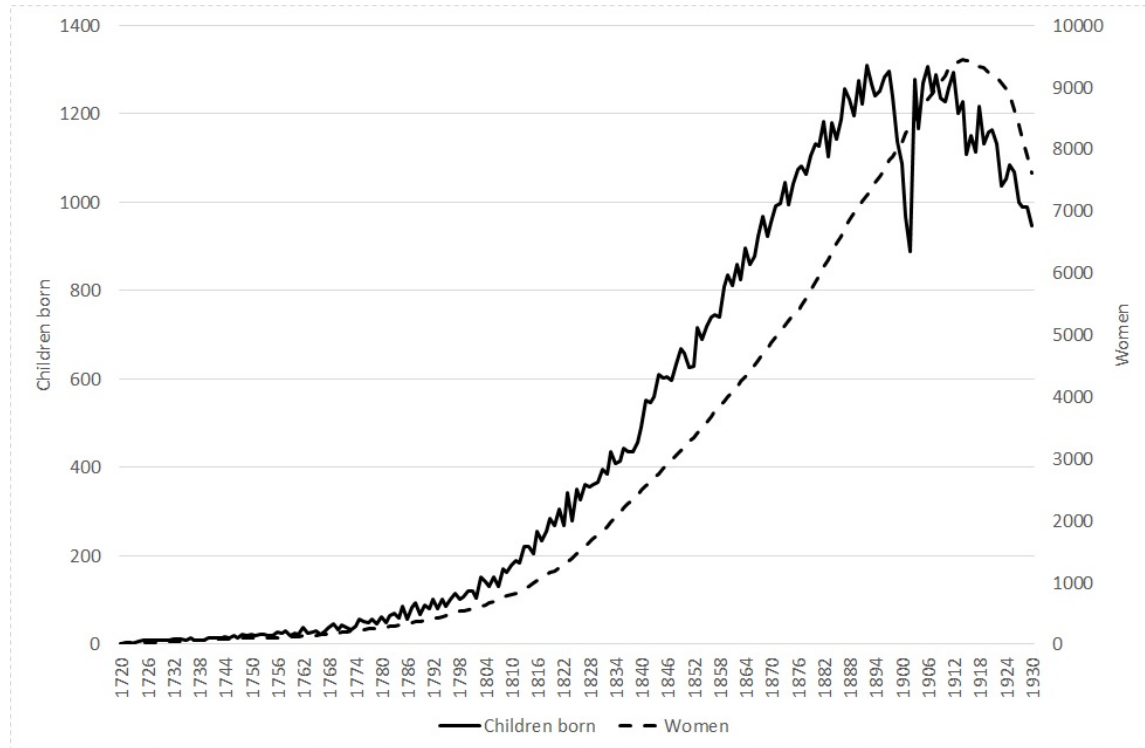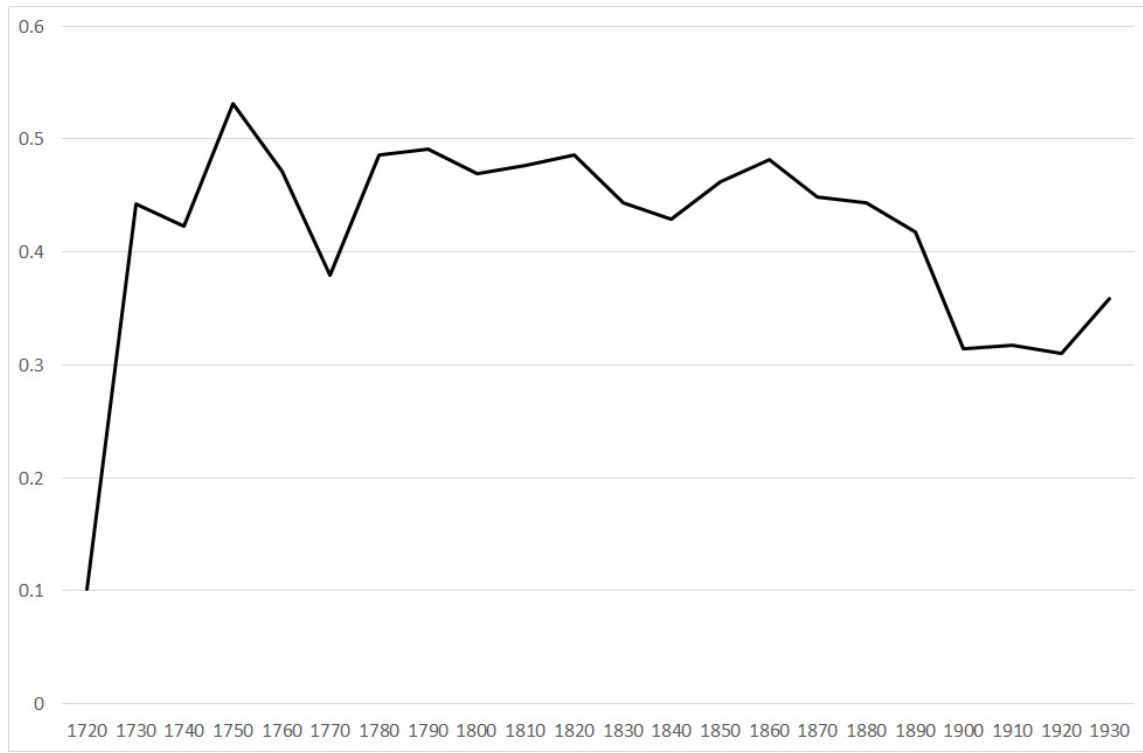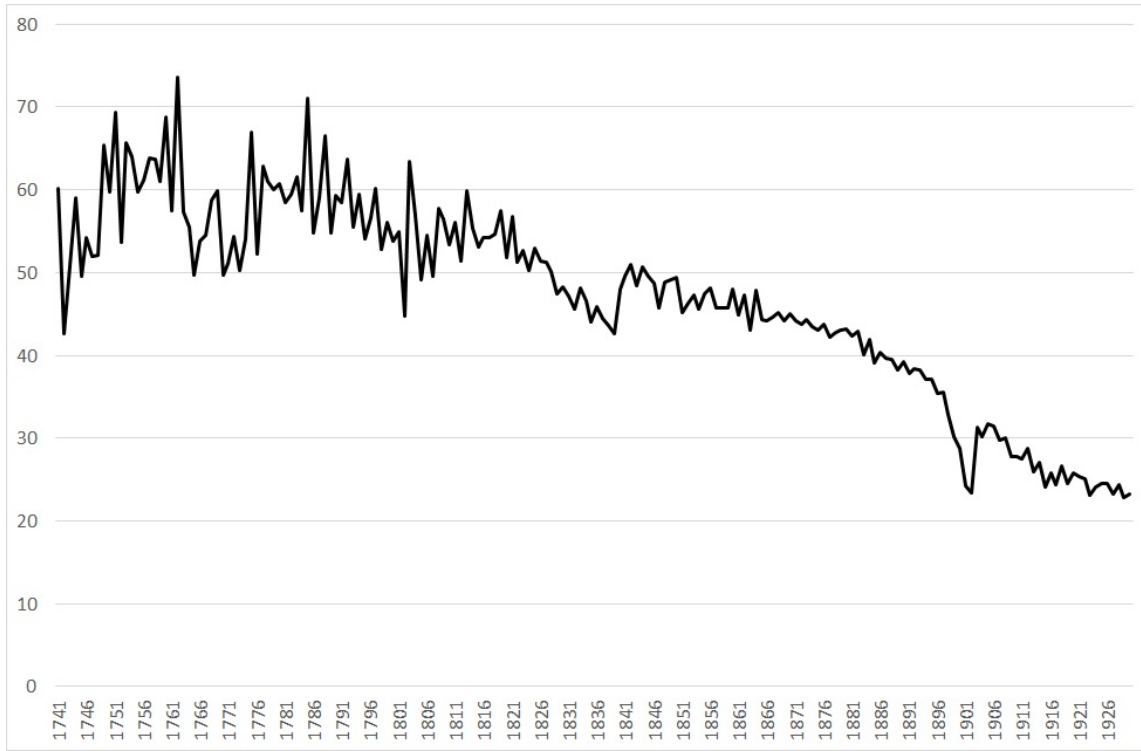
Figure B.2: I_g from 1730 - 1930 by decade

Does not include childless women. The inclusion of childless women would lower the index further.

Figure B.3: Crude birth rate, 1740 - 1930

Does not include childless women.

Figure B.4: Old Urban parity with Confidence Intervals

Figure B.5: Old Rural Arable parity with Confidence Intervals

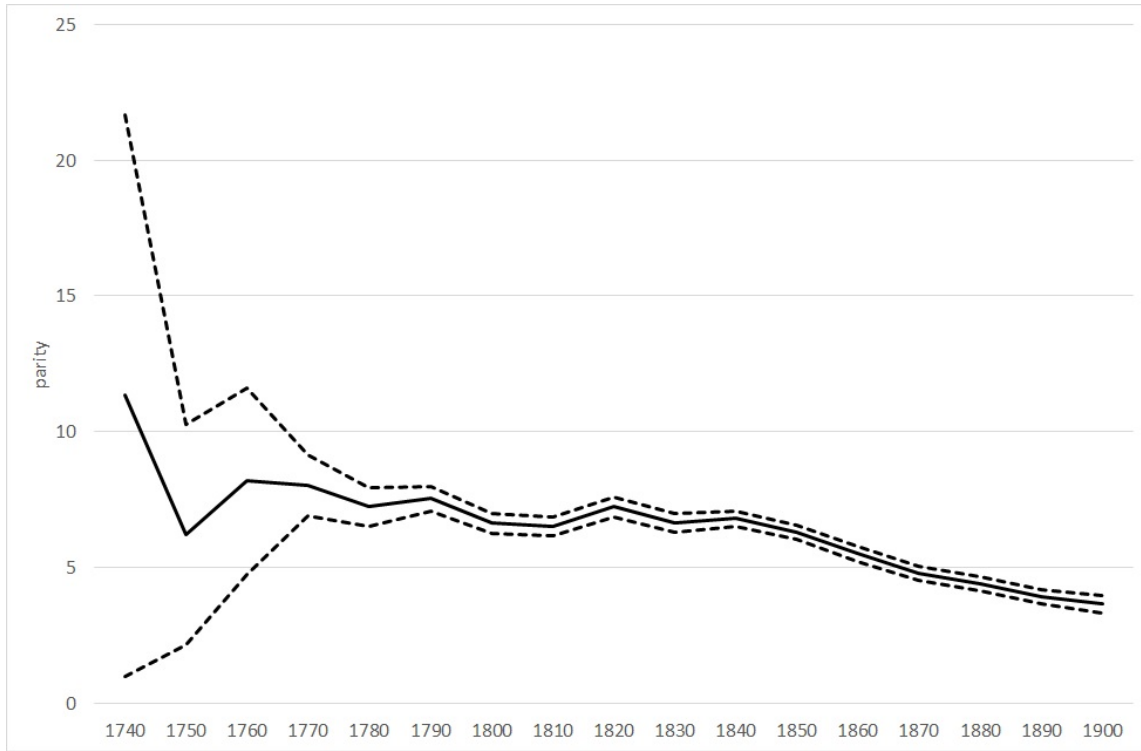Figure B.6: Old Frontier parity with Confidence Intervals

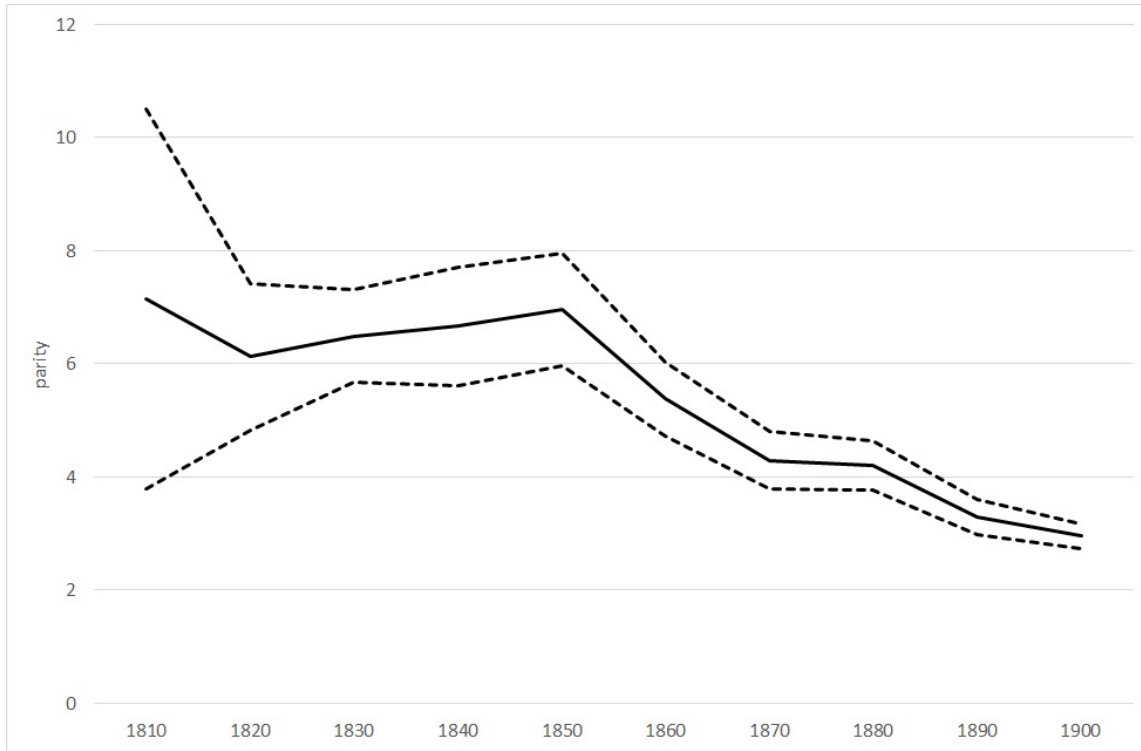Figure B.7: New Urban parity with Confidence Intervals
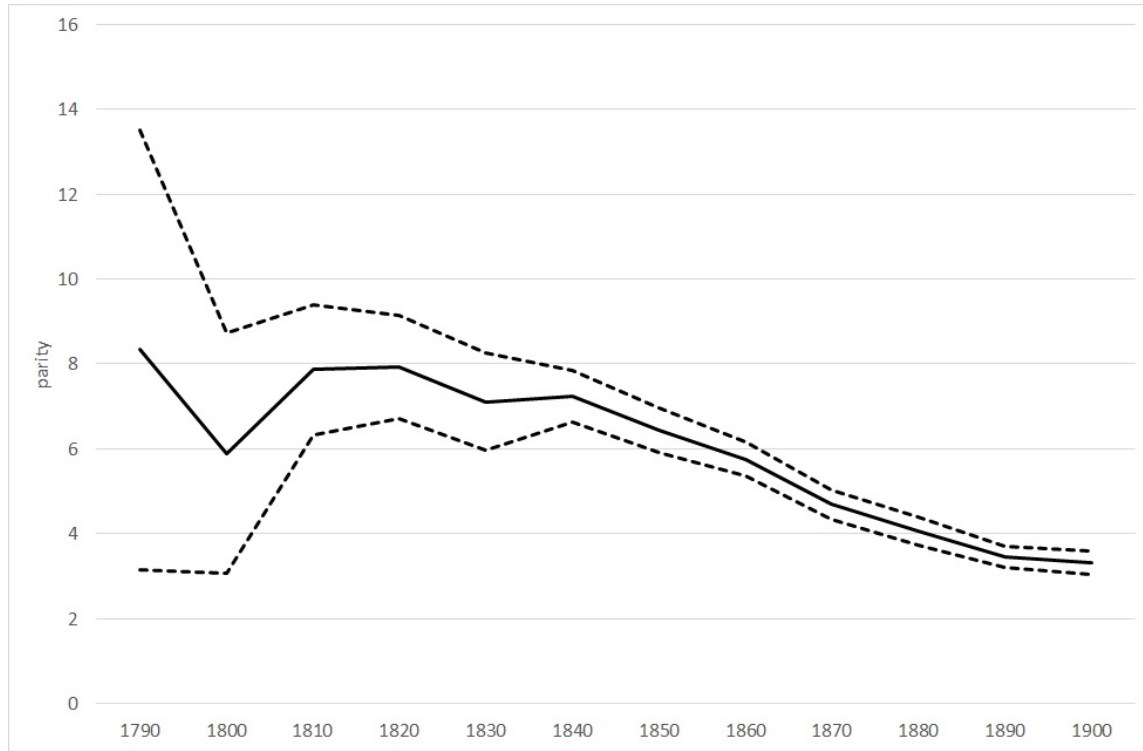
Figure B.8: New Frontier Arable parity with Confidence Intervals

Figure B.9: New Frontier Dry parity with Confidence Intervals