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The Fall of Fertility in Tasmania, Australia, in the late 19th and early 20th centuries.

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ABSTRACT

The paper examines the fall of marital fertility in Tasmania, the second settled Australian colony, in the late 19th and early 20th centuries. The paper investigates when marital fertility fell, whether the fall was mainly due to stopping or spacing behaviours, and why it fell at this time. The database used for the research was created by reconstituting the birth histories of couples marrying in Tasmania in 1860, 1870, 1880 and 1890, using digitised 19th century Tasmanian vital registration data plus many other sources. Despite Tasmania's location on the other side of the world, the fertility decline had remarkable similarities with the historical fertility decline in continental Western Europe, England and other English-speaking countries. Fertility started to decline in the late 1880s and the fertility decline became well established during the 1890s. The fall in fertility in late 19th century Tasmania was primarily due to the practice of stopping behaviour in the 1880 and 1890 cohorts, although birth spacing was also used as a strategy by the 1890 cohort. The findings provide support for some of the prominent theories of fertility transition.

Keywords: Historical fertility decline, Tasmania Australia, Theories of fertility decline, Stopping and spacing behaviours, Socioeconomic status, Infant mortality, Geographic location.

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1 INTRODUCTION

In most Western European countries, the fertility transition took place between 1880 and 1930, although the decline began earlier in France i.e. from the late 18th century (Cleland 2001; Coale 1986). Most scholars consider that the fertility decline began in England in the 1870s and that fertility fell from around the same period in other English-speaking countries (Caldwell 1999; Gauvreau & Gossage 2001; Hacker 2003; Woods 1987). Fertility fell from the 1880s in Australia (Caldwell 1999; Coghlan 1903; Jones 1971; Ruzicka & Caldwell 1977), although the timing of the fertility decline varied somewhat between the colonies, falling first in Victoria from around the mid-1870s and from the 1880s in all other colonies, except Western Australia (Jones 1971; Quiggin 1988).

This paper examines the fall of marital fertility in Tasmania, the second settled Australian colony, in the late 19th and early 20th centuries, using an individual-level database of reconstituted birth histories of couples marrying in Tasmania in the second half of the 19th century (Moyle 2015, 2016). This is the first study to use multivariate methods to examine the Australian fertility transition, since Australian micro data for the period are very limited (Moyle 2015). The paper examines when marital fertility fell and to what extent the fall was due to stopping or spacing behaviours. The results are then examined to see whether they provide support for theories of why fertility fell during this period, including demographic transition theory; economic theories; changes in women's roles and status in society and in the family; diffusion theory; secularisation; and trends in infant and child mortality.

2 THEORIES OF FERTILITY DECLINE

2.1 THEORIES OF WHY FERTILITY DECLINED

Theories as to why marital fertility declined in Western Europe and English speaking countries in the late 19th and early 20th centuries have been reviewed by several authors (e.g. Abbasi-Shavazi et al. 2009; Alter 1992; Cleland & Wilson 1987; Hirschman 1994; McDonald 2001; van de Kaa 1996). These theories are often difficult to test and the evidence is sometimes contradictory. From the middle of the 20th century, there was an ongoing debate in historical demography as to whether the fertility decline was primarily caused by 'adjustment' to new social and economic conditions or to 'innovation', i.e. the diffusion and acceptance of innovative ideas and behaviours (Carlsson 1966; Cleland & Wilson 1987). It is generally agreed nowadays, however, that the 'two sets of explanations are complementary, not competing' (Casterline 2001: 3) As McDonald concludes 'both adaptation and innovation are necessarily involved because people cannot change their behaviour without the necessary knowledge (innovation) nor do they do so without reason (adaptation)' (McDonald 2001: 1). This reflects Coale's three major preconditions for a decline in marital fertility: 'Fertility must be within the calculus of conscious choice … perceived social and economic circumstances must make reduced fertility seems advantageous to individual couples … (and) … effective techniques of fertility reduction must be available' (Coale 1973: 65). Demographic transition theory, economic theories, and theories about the roles of women relate to 'adjustment' of the population to new social and economic conditions while theories of diffusion, secularisation and improved contraception relate to 'innovation'. However, these theories can overlap and the distinction between 'adjustment' and 'innovation' theories is not always clear cut.

According to demographic transition theory, fertility declined in the 19th century in Western Europe and English speaking countries, because of modernisation, industrialisation and urbanisation (Notestein 1945; 1983). There was a decline in mortality followed by a decline in fertility, which was a 'response to drastic changes in the social and economic setting that radically altered the motives and aims of people with respect to family size' (Notestein 1945: 50). While Notestein's original theory is considered too broad to explain the historical fertility decline (Hirschman 1994), researchers have found that social and economic change was likely to have played an important role in the decline (Brown & Guinnane 2002; Dribe et al 2014; Galloway et al. 1994; Lee et al. 1994; Schellekens & Van Poppel 2012).

Economic theories of fertility decline specifically relate to people's responses to new social and economic conditions. Economic demand theory asserts that the demand for children will fall when the cost of having another child is greater than the benefit of having that child (Becker 1981; Becker et al. 1990; Easterlin 1975). Fertility falls in conditions where the costs of children increase and exceed the social and psychological benefits of having another child (Abbasi-Shavazi et al. 2009). Becker (1981) argues that with economic development, the returns on investment in human capital (that is, education and training) increase and that this shifts family expenditure 'towards quality and away from quantity' as each child becomes more expensive to rear (Becker 1981: 111). Caldwell considers that the introduction of mass education played a major role in the fertility decline in the late 19th century, because children became a cost rather than an economic benefit (Caldwell 1999). Another economic theory focusses on families' longer term views of their economic future (Abbasi-Shavazi et al. 2009). According to this theory parents began to limit their fertility because of their social and material aspirations for themselves and their children (Banks 1954; Lesthaeghe & Wilson 1986). Upper- and middle-class families were the first to limit their fertility and were progressively followed by those of lower socio-economic status.

Historical demographers have often ignored women's roles and their changing status in the public and the private spheres as an explanation for the 19th century fertility decline. However, others have argued that particular attention should be paid to 'those cultural features that determine the status of women and their ability to assert their own wishes regarding childbearing' (Knodel and Van de Walle 1979: 240). Some authors consider that it should be impossible to study the historical fertility transition without considering the part played by changing power relations between husband and wife (Folbre 1983; McDonald 2000). Gender equity within the family is a necessary condition for fertility to decline and is facilitated through women's education (McDonald 2000). Not only do educated women become receptive to new ideas, but education improves their autonomy and power within the family (Breschi et al. 2014).

According to theories of diffusion, fertility fell because of the diffusion of knowledge, ideas and values about fertility control throughout society (Cleland & Wilson 1987; Knodel & Van de Walle 1979; Lesthaeghe 1977). The highest socio-economic status families were the first to take up the innovative behaviour and the knowledge, ideas and values spread from elites to the upper and middle classes and then to the working classes (Bengtsson & Dribe 2014; Breschi et al. 2014; Dribe et al. 2014; Schellekens & Van Poppel 2012; Vézina et al. 2014). New ideas generally originate in urban settings and ideas about fertility control and information about methods of control are likely to spread more quickly within a densely populated community (Galloway et al. 1994). Fertility thus declined earlier in urban than in rural areas (Gauvreau & Gossage 2001; Livi-Bacci 1986; Sharlin 1986; Vézina et al. 2014). Education encourages people to be receptive to new ideas and behaviour and gives them the skills to access this information (Cleland 2001). Parents with a higher education were therefore the first to take up new ideas about fertility control.

Some authors have argued that the spread of secularisation throughout Europe in the 19th century affected families' views on and practice of fertility limitation and was a necessary condition for the adoption of fertility control (Lesthaeghe & Wilson 1986). The basic tenet of secularisation was 'individual responsibility', and according to this ethos, fertility, like many other aspects of life, was viewed as being under the individual's control rather than being subject to 'God's will'. Non-orthodox Protestant communities tended to adapt to secularisation earlier than Catholic and orthodox Protestant communities and were quicker to adopt fertility control (Lesthaeghe & Wilson 1986; Gauvreau & Gossage 2001; Van Bavel & Kok 2005; Van Poppel & Derosas 2006)

While some authors claim that the increase in the manufacture and use of new artificial contraceptives played a major part in the historical fertility decline, this theory is very contentious (McLaren 1990). Quantitative data on the different methods of contraception used during the historical fertility decline are rarely available (Moyle 2015). This theory has been examined for the Tasmanian historical fertility decline using qualitative data (McDonald and Moyle 2016; Moyle 2015).

In relation to theories of infant mortality, while demographic transition theory posits a relationship between infant mortality and fertility at the societal level, four main theories have been put forward to explain the relationship at the individual level. These are the 'physiological'; 'insurance'; 'replacement'; and 'societal' theories (Preston 1978; Van de Walle 1986). The 'physiological' relationship between infant mortality and fertility refers to the relationship between breastfeeding and fecundity. When a child dies in infancy, a woman no longer avoids conception through breastfeeding and the space between the birth of the child who died and the subsequent child is reduced, leading to higher fertility

(Knodel 1978, 1982; Wrigley et al. 1997). The 'insurance' relationship applies in a context of high infant mortality, in which people have as many children as possible because of their perception of the risk of their children dying (Knodel 1978; Van Poppel et al. 2012). In the 'replacement' relationship, on the other hand, parents have a child to replace an infant or child who dies (Alter et al. 2010; Breschi et al. 2014; Knodel 1978). It has been suggested that the replacement strategy may be related to the sex of the child who died (Preston 1978). The 'societal' strategy refers to situations in which social norms around nuptiality or breastfeeding ensure that fertility is kept in equilibrium with mortality (Knodel 1978). Both the 'insurance' and 'replacement' theories imply that parents make a conscious choice to have a certain number of children, or to have another child, and in the case of the 'replacement' theory are practising deliberate fertility control with a specific family size in mind (Knodel 1982).

2.2 STOPPING AND SPACING

There has been debate among demographers as to the extent to which fertility declined in the late 19th century through changes in 'spacing' or 'stopping' behaviours (Okun 1995). This relates to the debate about the importance of the 'innovation' theory versus the 'adjustment' theory (van Poppel et al. 2012). 'Stopping' behaviour is viewed as an innovative form of behaviour, which incorporates ideas that were unthinkable in pre-transition societies (Cleland & Wilson 1987; Coale 1986; Knodel & van de Walle 1979). 'Spacing' behaviour, on the other hand, is viewed as an extension of behaviour that was practised before the fertility decline, but became a way that couples adjusted to new economic and social conditions during the decline (Anderton & Bean 1985; Santow 1995; Szreter 1996; Van Bavel 2004a; Van Bavel & Kok 2004).

In the mid-20th century, an influential group of demographers argued that in late 19th century Western Europe, couples began to deliberately limit their fertility through 'stopping' behaviour (Henry 1961; Coale 1986). This was an entirely new behaviour which was taken up to such an extent that it initiated the fertility decline (Knodel & van de Walle 1979). According to this theory, first put forward by Henry (1961), couples use contraceptive methods, such as withdrawal, artificial methods, or abortion to avoid having more births after they have had a certain number of children and have decided that they do not want any more. Henry contrasted this with behaviours such as prolonged breastfeeding, which increase birth intervals, but are not parity related. Birth spacing strategies can be used after any parity, including the first, and couples do not change their behaviour once they have reached a specific family size. Henry termed fertility which is deliberately controlled through 'stopping' at a specific parity as 'controlled fertility' and fertility where people practise non-parity limiting behaviours as 'natural fertility'.

Coale (1986) argued that fertility fell in Western Europe because of a change from 'spacing' behaviour to 'stopping' behaviour, with couples changing from non-parity specific fertility limiting behaviours to parity-specific limiting behaviours (Coale 1986: 9). Knodel's (1987) study of couples marrying in the 18th and 19th centuries in 14 German villages found that stopping having children before the end of the reproductive period was the major method used to control fertility during the fertility decline.

Other demographers have argued that deliberate birth spacing, that is, intentionally lengthening the time between births early on in marriage, played an important role in the fertility decline (Anderton & Bean 1985; Bean at el. 1990; Hionidou 1998; Santow 1995; Szreter 1996). Analyses of fertility in 19th century Utah show that stopping behaviour was an important fertility control strategy during the fertility decline, but that birth spacing was also used as a strategy to limit fertility (Anderton & Bean 1985; Bean et al. 1990). Studies of populations in parts of Western Europe have shown that spacing behaviour was used by some families to control their fertility prior to the fertility decline, particularly in times of economic stress (Dribe & Scalone 2010; Kolk 2011; Tsuya et al. 2010; Van Bavel 2004a; Van Bavel & Kok 2010).

Nowadays, as with the associated 'innovation/adaptation' debate, most scholars agree that both stopping and spacing behaviours played a part in the 19th century fertility decline, but that the extent to which these behaviours were responsible for the decline within a particular society is a matter for investigation (Van Poppel et al. 2012).

3 TASMANIA IN THE 19TH AND EARLY 20TH CENTURIES

Tasmania is an island situated off the south-east coast of mainland Australia, originally named Van Diemen's Land. The British established a penal colony on the island in 1803 and the two major cities, Hobart and Launceston, were established three years later (Reynolds 2012). In its first 50 years, the colony's history was dominated by convict settlement, but after transportation ceased in 1853, the convict society petered out. By 1857, free settlers or people born in the colony accounted for the majority of the population. The population grew rapidly during its early years, from 8,422 in 1822 to 81,492 in 1857 (Borrie 1994). At the same time, however, the Indigenous population which was estimated at about 7,000 in 1817, decreased to less than 250 by 1830, mainly due to massacre by the European population (Boyce 2010; Kippen 2002).

Tasmania was highly dependent on agriculture in its early years, mainly sheep farming, but from the 1870s mining emerged as a major industry including tin, gold, silver, bismuth, antimony, coal and copper (Reynolds 2012). The colony was prosperous from settlement until the mid-1850s when a depression set in, but this lifted in the early 1870s with the mining discoveries. Like most other Australian colonies, Tasmania experienced a great depression in the early 1890s, but the economy improved at the end of the 19th and in the early 20th centuries. The late 19th and the early 20th centuries were a time of great social and economic change for the colony, with improvements in communication, transportation, the introduction of electricity to cities, compulsory primary education, married women's property legislation and universal suffrage (Moyle 2015).

A number of religious denominations established ministries in the colony, including the Anglicans (Church of England), Catholics, Methodists, Presbyterians, Congregationalists and Baptists (Moyle 2015). Despite this, Tasmania appears to have been a relatively secular society throughout the 19th and early 20th centuries. Tasmanians generally married in church, had their children baptised and were buried according to religious rites, but in most cases the church did not have a major influence over their lives. Religion was generally not as important to people in Australia as in Britain or the United States (Breward 1988).

Nineteenth-century Australia has been described as one of the 'most isolated settler outposts of the British Empire' and 'isolated from the great metropolises of Europe and the United States' (Anderson & McKinnon 2015: 9), but historical evidence does not support this view. Tasmania was not an isolated place in the second half of the 19th century (Haynes 1976; Reynolds 2012; Robson and Roe 1997). There was considerable communication and movement of people between Tasmania and other colonies and countries such as England (Moyle 2015). Not only did people migrate to Australia from England, but Australian settlers, particularly the upper classes, made visits to England. With the establishment of a telegraphic cable between Tasmania and London in 1872, Tasmanian newspapers were able to publish news from around the world, particularly articles and reports from the English newspapers, with very little delay. Books, pamphlets, magazines and journals from overseas were also available in Tasmania throughout the 19th century.

By the last decade of the 19th century, a high proportion of the population was born in Tasmania and was literate (Moyle 2015). There was a large rise in white-collar and 'modern' occupations, communication was good and news from other colonies and overseas reached Tasmania quickly. The population was not strongly religious and there was a relatively high urban-orientation. The upper-class in Hobart and Launceston had a sophisticated "society" lifestyle, much like that of the upper-class in England. The island's population almost doubled between 1870 and 1911, from 99,328 to 191,211 (Borrie 1994).

4 DATA DESCRIPTION

The database used for this research was created by reconstituting the birth histories of couples marrying in Tasmania in 1860, 1870, 1880 and 1890, using digitised 19th century Tasmanian vital registration data plus many other sources (Gunn & Kippen 2008; Moyle 2015, 2016). The family reconstitution involved tracking couples from their marriage through to the end of the wife's childbearing years or to the death of the husband and/or wife, whichever was earlier. The study population was composed of couples where the wife was in her first marriage, they had at least one child of the marriage and both husband and wife survived the wife's childbearing years. In order to distinguish stopping and spacing behaviours, a database was needed where the last birth could be identified with confidence.

The database consisted of 3,184 couples marrying in Tasmania in the years 1860, 1870, 1880 and 1890 (Table 1). The majority of couples marrying in Tasmania in these years were couples where the wife was in her first marriage and there were children of that marriage. The remainder were couples where the wife was in her first marriage and there were no children of the marriage and couples where the woman was a widow when marrying. There were three types of couples where the wife was in her first marriage and there were children of that marriage: 'complete' couples were those where both parents survived the childbearing years (the study population); 'incomplete' couples where one or both parents died during the wife's childbearing years; and 'unobserved' couples, where the couple could not be traced to the end of the wife's childbearing years (Moyle 2016).

Table 1 *Type of marriage: 1860, 1870, 1880 and 1890 marriage cohorts Tasmania*

	1860	1870	1880	1890
Type of marriage	Number			
Wife's first marriage with children: complete	256	283	417	529
Wife's first marriage with children: incomplete	121	122	156	162
Wife's first marriage with children: unobserved	75	40	59	50
Other marriages (1)	261	228	214	211
Total	713	673	846	952
	Per cent			
Wife's first marriage with children: complete	35.9	42.1	49.3	55.6
Wife's first marriage with children: incomplete	17.0	18.1	18.4	17.0
Wife's first marriage with children: unobserved	10.5	5.9	7.0	5.3
Other marriages (1)	36.6	33.9	25.3	22.2
Total	100.0	100.0	100.0	100.0

(1) Includes widows and women in their first marriage with no children of the marriage

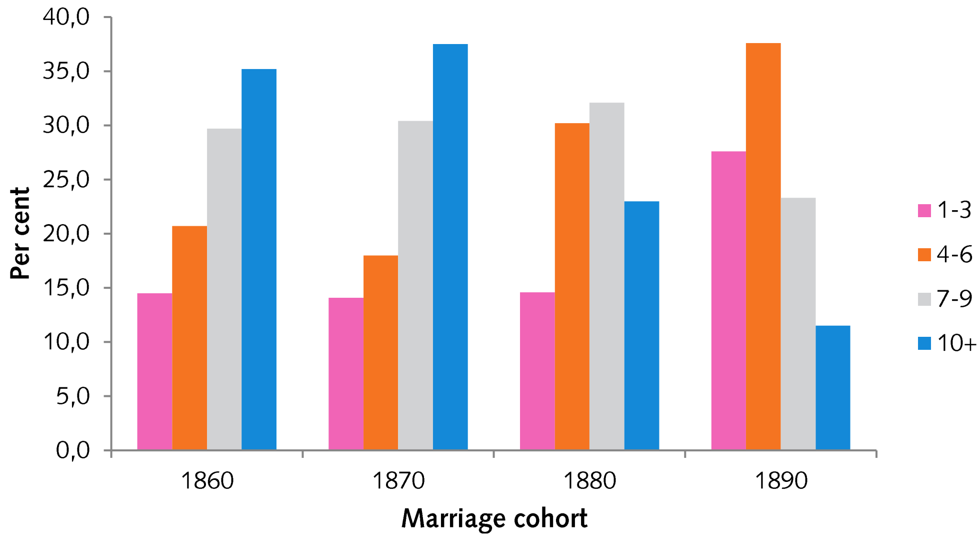
5 THE HISTORICAL FERTILITY DECLINE IN TASMANIA

5.1 FAMILY SIZE

The mean number of children born to couples in the complete group fell from 7.84 and 7.98 for families in the 1860 and 1870 marriage cohorts respectively, to 7.06 for families in the 1880 marriage cohort and to 5.62 for families in the 1890 cohort. The 1860/70 levels of completed fertility are very similar to the completed fertility of couples in Utah who married around the same time, although fertility declined more slowly in Utah (Mineau et al. 2002).

The fall in the mean number of children from the 1870 cohort to the 1890 cohort was due to a decline in the proportions of large and very large families and an increase in the proportions of small and medium-sized families (Figure 1).

Figure 1 Proportion of families by number of children, complete group, 1860, 1870, 1880 and 1890 marriage cohorts Tasmania.



Source: Table A1.

A relatively large proportion of couples in the 1860 and 1870 cohorts had very large families, with 35.2 per cent of the 1860 cohort and 37.5 per cent of the 1870 cohort having 10 or more children (Figure 1 & Table A1). The proportion of couples with very large families fell markedly to 23.0 per cent in the 1880 cohort and then to 11.5 per cent in the 1890 cohort. The proportion of large families, 7–9 children, was around the same in the first three cohorts, but fell from the 1880 to the 1890 cohort. The proportion of small families, 1–3 children, remained at around 14 per cent in the three earlier cohorts, but almost doubled to 27.6 per cent in the 1890 cohort, while the proportion of medium sized families, 4–6 children, increased from the 1870 to the 1880 cohort and then to the 1890 cohort.

The decline in family size between the 1870 and 1880 cohorts was different from the decline between the 1880 and 1890 cohorts. The decrease in the proportion of very large families and increase in the proportion of medium sized families began in the 1880 cohort, while the decrease in the proportion of large families and increase in the proportion of small families did not occur until the 1890 cohort. This suggests that the 1880 and 1890 cohorts were stopping their childbearing at different parities.

Parity progression ratios were fairly similar for mothers in the 1860 and 1870 cohorts (Table A2). However, parity progression ratios began to fall from the third to the fourth child onwards in the 1880 cohort and from the second to the third child onwards in the 1890 cohort.

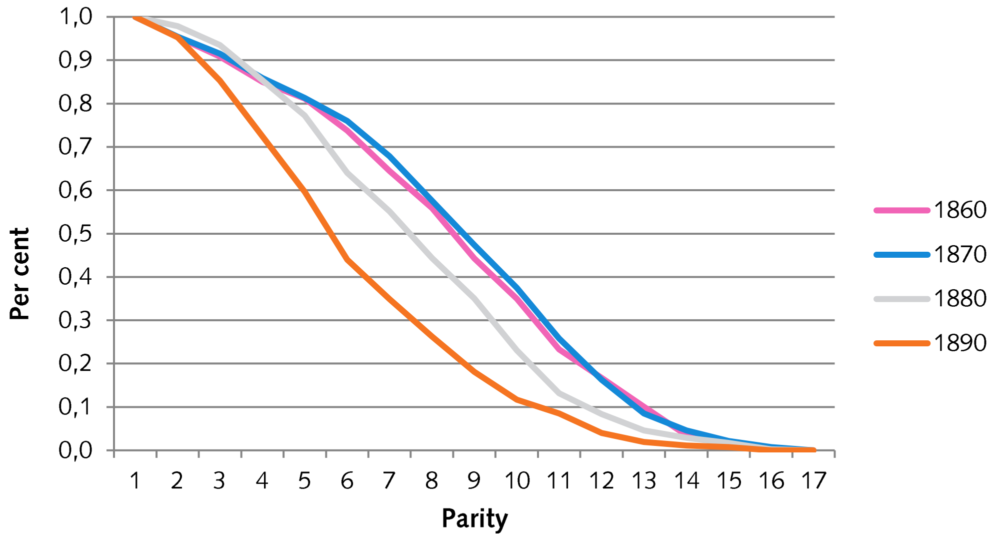
It is possible to calculate the proportion of mothers reaching each parity using parity progression ratios:

*proportion of mothers having 'i' children = proportion of mothers having 'i-1' children * parity progression ratio 'i'.*

This is a useful way of measuring the fertility and changes in fertility of different groups.

The fertility levels of the 1860 and the 1870 cohorts were very similar with very small differences in the proportions of women reaching each parity (Figure 2). For example, 85.6 per cent of women in the 1860 cohort had four or more children compared with 85.9 per cent in the 1870 cohort, while 56.3 per cent of the 1860 cohort had eight or more children compared with 57.6 per cent of the 1870 cohort.

Figure 2 Proportion of women reaching each parity, complete group: 1860, 1870, 1880 and 1890 marriage cohorts Tasmania.



Source: Table A3.

Fertility fell from the 1870 cohort to the 1880 cohort and then to the 1890 cohort. From the 1870 to the 1880 cohort, the proportions of women reaching each parity began to fall steadily after parity four. In the 1870 cohort, for instance, 76.0 per cent of mothers had six or more children, compared with 64.0 per cent of mothers in the 1880 cohort, while for those with 11 or more children, the proportions were 25.8 per cent and 13.2 per cent respectively.

There was a much larger fall in fertility from the 1880 to the 1890 cohort, with the proportion of women reaching each parity dropping sharply after parity two. In the 1880 cohort, for example, 85.4 per cent of mothers had four or more children compared with 72.5 per cent in the 1890 cohort, while 35.0 per cent of mothers in the 1880 cohort had nine or more children compared with 18.1 per cent in the 1890 cohort.

Since the proportions of mothers reaching each parity were very similar in the 1860 and 1870 cohorts and the numbers in each cohort are considerably smaller than in the other two cohorts, these cohorts are combined in multivariate analysis that follows.

5.2 MEASURING STOPPING AND SPACING BEHAVIOURS

There has been considerable controversy among scholars as to the methods used to identify stopping and spacing behaviour using historical data (Van Bavel 2004b). In particular, measures to detect deliberate spacing behaviour are difficult to find (Knodel 1987).

In the past twenty years or so, multivariate methods, particularly survival analysis, have become commonly used by demographers to examine the historical fertility decline (Gutmann & Alter 1993; Van Bavel 2004b) The survival approach, however, does not distinguish between fertility-limiting spacing and stopping behaviours, since it models the 'risk of having the next birth', which can reflect either the length of the next birth interval (spacing) or whether the woman stops having children (stopping) (Berger et al. 2009; Gray et al. 2010). Since the Tasmania data includes only couples who have completed their fertility, logistic regression is used to examine stopping behaviour and survival analysis on closed birth intervals to examine spacing behaviour (Van Bavel 2004a; b; c).

5.3 STOPPING BEHAVIOUR

The following covariates were used in the logistic regression to examine the determinants of any given birth being the last. These covariates relate to theories of fertility decline discussed earlier or are associated with a woman's fecundity:

- Mother's age at the birth of a child
- Mother's age at marriage
- Difference in age between husband and wife
- Marriage cohort
- Father's socio-economic status
- Type of geographic location
- Religion
- Literacy status of husband and wife
- Whether a pregnancy resulted in the birth of twins
- Last born child died while the mother was not pregnant with another child
- The number of children alive at the beginning of the birth interval, that is, the number of children born to the couple minus the number of children who had died (under the age of 15 years)
- The number of children who had died (under the age of 15 years) at the beginning of the birth interval
- The sex composition of the surviving children at the beginning of the birth interval

Father's occupation appears on every birth registration and often changed from birth to birth. These occupational data were classified to the detailed five digit classification system of the Historical International Classification of Occupation (HISCO). Each HISCO code was then classified to one of the twelve occupational HISCLASS categories to obtain a measure of socioeconomic status (Van Leeuwen and Maas 2005). Because of small numbers in some groups, father's socio-economic status was reclassified into five groups: white-collar (HISCLASS 1,2,3,4 & 5); skilled workers (6 & 7); farmers (8); lower skilled workers (9 & 10); and unskilled workers (11 & 12). 'Gentleman' farmers were reclassified as 'white-collar' workers (Meikle 2011; Reynolds 1969, 2012).

Religion refers to the religious rites according to which the parents were married, that is, the religion that appears on the marriage registration. Couples who married according to the rites of the Church of England or the United Church of England and Ireland were classified as *Anglican* and those married according to the rites of the Holy Catholic Church as *Catholics*. *Presbyterians* consist of couples marrying according to the rites of the (Free) Presbyterian Church, and the (Free) Church of Scotland. *Methodists* are couples who married according to the rites of the Wesleyan Methodist Church, the Primitive Methodist Church and the United Free Methodist Church. *Other Nonconformists* consist of couples who married according to the rites of the Baptist Church, Congregational / Independent Church, the Christian Mission Church and those marrying in a civil ceremony.

'Literacy' of the husband and/or wife refers to whether or not the person signed the marriage certificate.

Testing for multi-collinearity of the covariates showed that the covariates in the logistic regression model are not highly correlated. Descriptive statistics of the covariates used in the model are shown in Table A4.

The logistic regression shows the importance of the period in which a woman was giving birth, in that women in the 1880 cohort were more likely to stop childbearing than those in the 1860/70 cohort and women in the 1890 cohort were even more likely to stop (Table 2). The older a woman was at the birth of her child, the more likely she was to stop childbearing. Similarly, the older a woman was at marriage, the more likely she was to stop. Farmers, unskilled workers and skilled workers were less likely to stop than white-collar workers and people living in rural areas of Tasmania were less likely to stop than those living in urban areas. The age difference between husband and wife, religion, literacy, and giving birth to twins had no significant association with stopping. However, the more surviving children the couple had the more likely they were to stop, but the sex of these children had no

Table 2 Logistic regression of the probability that a birth is the last, complete group: 1860/1870, 1880 and 1890 marriage cohorts, Tasmania.

Covariate	**Odds ratio**	**Standard error**	**Significance (p)**	
Intercept	0.01	0.003	0.000	**
Mother's age at the birth				
<30 years (ref.)	1.00	–	–	
30-<35 years	1.44	0.237	0.027	*
35+ years	4.22	0.700	0.000	**
Mother's age at marriage				
<20 years (ref.)	1.00	–	–	
20-<25 years	1.51	0.120	0.000	**
25+ years	2.22	0.259	0.000	**
Age difference between couple				
Same age or husband up to 5 years older (Ref.)	1.00	–	–	
Wife older	0.94	0.088	0.544	
Husband 5+ years older	1.07	0.074	0.352	
Marriage cohort				
1860/70 cohorts (ref.)	1.00	–	–	
1880 cohort	1.42	0.111	0.000	**
1890 cohort	2.20	0.172	0.000	**
Socioeconomic status				
White-collar (ref.)	1.00			
Skilled	0.81	0.085	0.041	*
Farmers	0.62	0.059	0.000	**
Lower skilled	0.86	0.098	0.201	
Unskilled	0.65	0.062	0.000	**
Type of geographic location				
Urban area in Tasmania (ref.)	1.00	–	–	
Rural area in Tasmania	0.69	0.053	0.000	**
Another colony	1.06	0.116	0.567	
Religion				
Anglican (ref.)	1.00	–	–	
Catholic	0.85	0.089	0.119	
Presbyterian	1.05	0.104	0.601	
Methodist	0.88	0.077	0.157	
Other Nonconformist	1.01	0.093	0.901	
Literacy status of husband and wife				
Both literate (ref.)	1.00	–	–	
Husband and/or wife illiterate	0.96	0.092	0.667	
Twin birth	1.60	0.407	0.063	
Child dies as infant before conception of another	0.88	0.115	0.324	
Number of child deaths	1.28	0.045	0.000	**
Number of surviving children	1.24	0.019	0.000	**
Sex composition of surviving children				
More surviving girls than boys (ref.)	1.00	–	–	
More surviving boys than girls	0.96	0.065	0.586	
Equals numbers of surviving boys and girls	0.98	0.090	0.798	
No. of births=9923				
Hosmer-Lemeshow chi2(8)=4.91 Prob>chi2=0.7673				

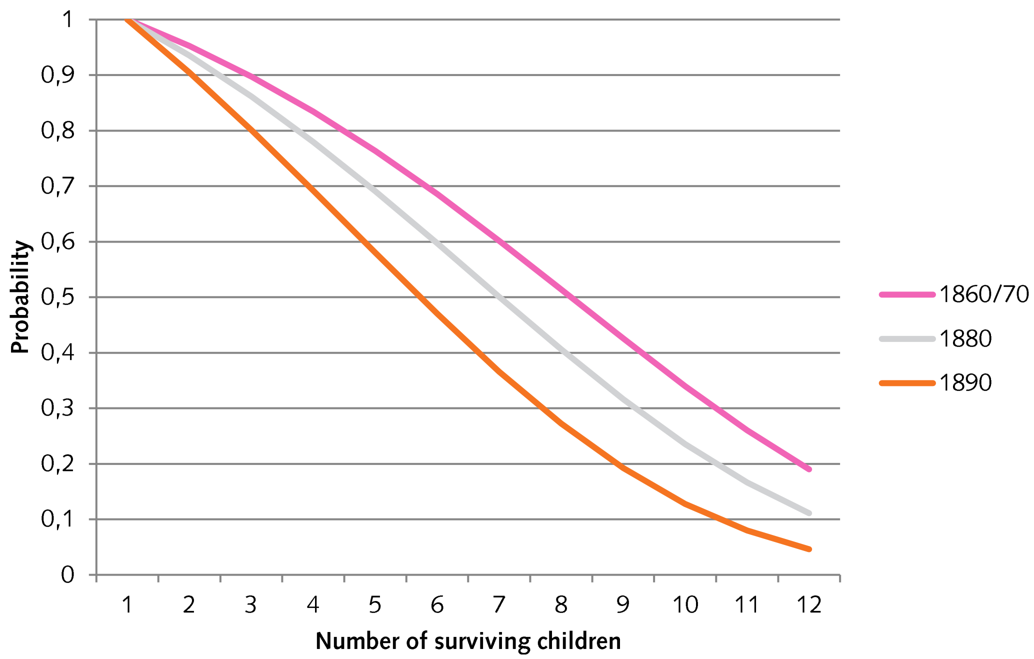
* P<0.05 ** P<0.01

significant association with stopping. Having an infant die while the mother was not pregnant had no significant association with stopping, but the more infant and child deaths the couple experienced, the more likely they were to stop.

The model was also run with interaction effects to see if the relationships within the socioeconomic groups, religious groups and those living in different geographic areas were consistent across cohorts. The interaction effects were not significant, so that there was no evidence that there were differences in the relationships within the groups in the different marriage cohorts.

The predicted probabilities of a birth being the last were calculated from the logistic regression model. The predicted probability of stopping, given the number of surviving children, can be used in the same way as the parity progression ratios to calculate the proportion of women in each cohort predicted to have at least a specific number of surviving children (Figure 3). The predicted probability of women in each marriage cohort having a specific number of surviving children dropped steadily across the marriage cohorts. For instance, the predicted probability of women having four or more surviving children dropped from 0.84 in the 1860/70 cohorts to 0.78 in the 1880 cohort and then to 0.69 in the 1890 cohort. Similarly, the predicted probability of women having ten or more surviving children dropped from 0.34 in the 1860/70 cohorts to 0.24 in the 1880 cohort and to 0.13 in the 1890 cohort. This indicates that couples in the 1880 and 1890 cohorts had different behaviours regarding the parity at which they stopped childbearing.

Figure 3 Predicted probability of women having at least a specific number of surviving children, complete group: 1860/70, 1880 and 1890 marriage cohorts, Tasmania.



Source: *Table A5.*

5.4 BIRTH SPACING

A piecewise exponential regression model was used to examine the estimated effects of various characteristics on birth spacing. The spacing analysis included couples with two or more children only. The interval between marriage and the first birth was not included in the model, since the marriage cohorts varied markedly in the proportion of first births that were conceived before marriage (Van Bavel & Kok 2004; Tsuya et al. 2010).

Table 3 Estimated effects (relative risks) of various characteristics on the time to the next birth (closed birth intervals), complete group: 1860/1870, 1880 and 1890 marriage cohorts, Tasmania

Covariate	**Relative risk**	**Standard Error**	**Significance (p)**	
Constant	0.07	0.005	0.000	**
Mother's age at birth of a child				
<25 years (ref.)	1.00	–	–	
25-29 years	0.75	0.025	0.000	**
30+ years	0.65	0.029	0.000	**
Mother's age at marriage				
<20 years (ref.)	1.00	–	–	
20-24 years	1.13	0.031	0.000	**
25+ years	1.55	0.073	0.000	**
Age difference between couple				
Same age/ husband up to 5 years older (ref.)	1.00	–	–	
Wife older	1.05	0.037	0.214	
Husband 5+ years older	1.01	0.025	0.645	
Marriage cohort				
1860/70 cohorts (ref.)	1.00	–	–	
1880 cohort	0.95	0.026	0.070	
1890 cohort	0.86	0.024	0.000	**
Socioeconomic status				
White-collar (ref.)	1.00	–	–	
Skilled	1.00	0.040	0.859	
Farmers	1.06	0.037	0.071	
Lower skilled	0.99	0.044	0.917	
Unskilled	1.04	0.037	0.186	
Type of geographic location				
Urban area in Tasmania (ref.)	1.00	–	–	
Rural area in Tasmania	1.07	0.030	0.014	*
Another colony	1.05	0.046	0.309	
Religion				
Anglican (ref.)	1.00	–	–	
Catholic	1.04	0.038	0.288	
Presbyterian	1.00	0.036	0.992	
Methodist	1.05	0.032	0.093	
Other Nonconformist	0.93	0.031	0.036	*
Literacy status of husband and wife				
Both literate (ref.)	1.00	–	–	
Husband and/or wife illiterate	0.96	0.031	0.224	
Twin birth	1.05	0.127	0.669	
Number of children (crude parity)	1.05	0.018	0.008	**
Number of surviving children	0.99	0.018	0.766	
Child dies as infant before conception of another	1.45	0.067	0.000	**
Last birth interval	0.42	0.014	0.000	**
Sex composition of surviving children				
More surviving girls than boys (ref.)	1.00	–	–	
More surviving boys than girls	1.01	0.024	0.640	
Equal numbers of surviving boys and girls	0.96	0.030	0.237	
No. of birth intervals=8,466				

*p<0.05, **p<0.01

The dependent variable was the length of a birth interval in months, rounded to one decimal place.

The same covariates were used as in the logistic regression with the following exceptions:

- 'Crude parity at the beginning of the birth interval', that is, 'number of children', was used to control for fecundity, since women with higher parities tend to have shorter birth intervals (Van Bavel & Kok 2004, 2010).
- 'Number of deaths of infants and young children' was excluded because of multi-colinnearity, once 'number of children' and 'number of surviving children' were included in the model.
- A dummy variable indicating whether the birth interval was the last was included, to account for the fact that last birth intervals are generally longer than other birth intervals, even in circumstances where there is no fertility control (Van Bavel & Kok 2004).

Descriptive statistics of the covariates used in the model are shown in Table A6.

The model shows that couples in the 1890 marriage cohort had longer birth intervals than couples in the 1860/70 cohorts (Table 3). Marriage cohort was significantly associated with the length of the birth interval, with intervals being significantly longer for women in the 1890 marriage cohorts compared with the 1860/70 cohorts. Birth intervals were significantly longer for women who gave birth when they were older, but were significantly shorter for women who married at older ages. Women in rural areas had significantly shorter birth intervals than those in urban areas, while 'Other Nonconformists (mainly Baptists and Congregationalists) had significantly longer birth intervals than Anglicans.

If the last child died in infancy before another was conceived, the time to the next birth was significantly shorter, probably reflecting the cessation of breastfeeding. The more births a woman had already had, the shorter the time to the next birth. However, the last birth interval was significantly longer than the other birth intervals.

The model was run with interaction effects to see if there were differences in spacing within socioeconomic status, geographic location and religious groups across the cohorts (Moyle 2015). This showed that farmers and unskilled workers had significantly shorter birth intervals than white-collar workers in the 1890 cohort compared with the 1860/70 cohort.

Analysis of mean and median birth intervals indicates that the differences between the cohorts in the length of birth intervals, other than the last, were not large, mainly in the order of 1–2 months (Moyle 2015). Last birth intervals were significantly longer in the 1890 cohort than in the 1860/70 cohorts. The mean birth interval increased from 38.4 months for the 1860/70 cohorts to 46.2 months for the 1890 cohort. This was mainly due to the increase in very long last birth intervals, with the proportion of last birth intervals that were 6 years or longer increasing from 7.0 per cent to 16.5 per cent. In the 1890 cohort, almost a fifth of long last birth intervals were 10 years or more. Analysis of couples having long last birth intervals across the marriage cohorts (Moyle 2015) strongly suggests that failed stopping was a major reason for the increase in long last birth intervals.

5.5 PARITY PROGRESSION

In order to investigate the timing of the fertility decline, a multivariate model was used to examine whether there were specific parities at which the 1880 and 1890 cohorts were likely to stop childbearing compared with the 1860/70 cohorts. Using a logistic regression model to examine parity progression produced odds ratios that were unreliable, so that survival analysis was used to examine the risks of a woman at a specific parity proceeding to the next parity.

The effects of various characteristics on parity progression were not estimated above parity nine, because of the small numbers at these higher parities.

The covariates used were the same as in the logistic regression, with the following exceptions:

- The covariate 'number of children dead' was excluded, since this was the obverse of the 'number of surviving children' at any parity
- The covariate 'twin birth' was excluded, because of the small number of twin births at each parity

- A different categorisation for 'mother's age at the birth' was used at low (1–4) and high (5–9) parities, because of the different numbers in the various categories as women aged.

The survival analysis models show that covariates that consistently had significant effects on the risk of progressing from one parity to another were: mother's age at the birth of a child; mother's age at marriage; marriage cohort; and whether the child died as an infant while the mother was not pregnant with another child (Moyle 2015).

Women in the 1890 marriage cohort had a significantly lower risk of having another birth than women in the 1860/70 cohorts at all parities except parities one and nine, and even at parity one, the risk was almost significant (relative risk=0.88, p=0.051). For those in the 1890 cohort, the relative risks of having another birth compared with those in the 1860/70 cohorts ranged from 0.77 at parity two to 0.58 at parity four (p<0.01). Women in the 1880 cohort also had a significantly lower risk of having another birth compared with those in the 1860/70 marriage cohort at parities four and five (relative risks=0.72 and 0.73 respectively, p=0.000).

6 DISCUSSION

The analysis presented in this paper indicates that fertility decline took place in Tasmania at around the same time as in the other Australian colonies, in continental Western Europe, England and other English-speaking countries. Fertility declined in Tasmania from the second half of the 1880s and the fall was well established during the 1890s. Fertility began to fall from the 1860/70 cohorts to the 1880 cohort but there was a much larger fall from the 1880 to the 1890 cohort. Compared with women in the 1860/70 cohorts, women in the 1880 cohort had a significantly lower risk of having another birth at parities four and five while women in the 1890 cohort had a significantly lower risk of having another birth at almost all parities from parity two onwards.

Analyses of stopping and spacing behaviour support both 'innovation' and 'adjustment' theories. The fall in fertility in late 19th century Tasmania was primarily due to the practice of stopping behaviour in the 1880 and 1890 cohorts. However, as in 19^{th} century Utah (Anderton & Bean 1985; Bean et al. 1990), birth spacing was also used as a strategy to limit fertility by the 1890 cohort. In all marriage cohorts, some groups had longer birth intervals than others suggesting that these groups were deliberately spacing their births before the fertility decline. However, the practice of deliberate spacing was not widespread and may have been counter-balanced by shorter birth intervals of couples marrying at later ages or those with large families, having little effect on fertility levels in the earliest cohorts.

The late 1880s and 1890s were the period in which Tasmanian couples began to control the size of their families. This was during a time of economic and social transformation in Australia, lending to support to demographic transition theory (Notestein 1945)

The practice of stopping and spacing behaviours varied by different family characteristics, lending support to some of the theories of why fertility declined at this time. Socioeconomic status was significantly associated with both stopping and spacing supporting both diffusion and economic theories of fertility decline. In Tasmania, as in other Australian colonies, parts of Western Europe, Canada and the United States, the upper and middle classes were the first to limit their fertility, followed by the other classes, with unskilled workers and farmers being the last to adopt fertility control (Anderson 1999; Bengtsson & Dribe 2014; Breschi et al. 2014; Dribe et al. 2014; Jones 1971; Livi-Bacci 1986; Schellekens & Van Poppel 2012; Vézina et al. 2014). In the 1890 cohort, white-collar workers were more likely to space their births, compared with farmers and unskilled workers, possibly because they were having their early births during a period of economic depression in the colony.

Geographic location was also significantly associated with stopping and spacing behaviours, supporting theories of diffusion. This was similar to the other Australian colonies, parts of Western Europe and Canada (Anderson 1999; Gauvreau & Gossage 2001, Jones 1971; Livi-Bacci 1986;, Sharlin 1986; Vézina et al 2014). In every marriage cohort, people living in urban areas were more likely to stop having children and more likely to space their births than people living in rural areas. This indicates that people in urban areas were controlling their fertility before the fertility decline.

The findings relating to religion provide mixed support for theories of secularisation. Although there were no significant differences between religious groups in stopping behaviour, there were some differences in spacing behaviour. Other Nonconformists (Congregationalists and Baptists) were more likely to space their births than Anglicans in every marriage cohort, indicating that they were deliberately spacing their births before the fertility decline. This may also support theories of diffusion, since Other Nonconformists may have had higher literacy than Anglicans because of their emphasis on reading the scriptures (Van Poppel et al. 2012). Methodists had significantly shorter birth intervals than Anglicans in the 1880 marriage cohort, but this is difficult to explain. The measure of religion used here (religion at marriage) may be rather weak, since it is a measure of religious affiliation not of religiosity. As noted, Australia was a relatively secular society and religion did not have a major impact on people's lives.

In Tasmania, as in 19th century Belgium (Alter 1988), literacy levels of husband and wife were not significantly associated with fertility control practices. Similarly to the Belgium study, however, the result may be due to the indicator used - whether or not the husband and wife signed the marriage register - being a weak measure of literacy. With the introduction of compulsory education in the late 1860s, education levels changed for everyone simultaneously, so that the change was more institutional than individual. By 1891, 95.5 per cent of men and women aged 15–20 years and 87.4 per cent of those aged 20 years and older could read and write. This supports theories of diffusion and gender equity.

Unlike Western Europe and the USA (Alter 1988; Alter et al. 2010; Breschi et al. 2014; Haines 1998; Knodel 1978; Schellekens & Van Poppel 2012; Vézina et al. 2014), the findings do not support the 'replacement' theory of infant mortality. In Tasmania, couples who had a child die in infancy while a mother was not pregnant with another were as likely to stop having children as other couples. Also, unlike Germany and the USA (Knodel 1978; Haines 1988), the Tasmanian findings do not support the 'insurance' theory of infant mortality. Rather than child mortality deterring couples from efforts to limit their fertility, similarly to the Netherlands (Schellekens & Van Poppel 2012), the more infant and child deaths the family experienced, the more likely they were to stop childbearing. It is likely that these couples did not want to have any more births, because they were concerned they would experience more child deaths.

Unlike the Netherlands and Spain (Reher & Sanz-Gimeno 2007; Van Poppel et al. 2012), the number of surviving children had no significant association with the time to the next birth indicating that couples were not adjusting their birth spacing in relation to deaths of infants or children. Unlike Utah and Germany (Bohnert et al. 2012; Sandström & Vikström 2013), but similarly to Belgium (Alter et al. 2010), the sex composition of the family also had no significant association with stopping or spacing practices.

However, in Tasmania there was a 'physiological' relationship between infant mortality and fertility found in England and many parts of Western Europe (Knodel 1978, 1982; Wrigley et al. 1997). Having a child die as an infant when the woman was not pregnant with another child significantly reduced the time to the next birth. This was because with the death of an infant the woman stopped breastfeeding and started to ovulate. The survival analysis of parity progression shows that women who had a child die as an infant had a significantly higher risk of having another birth than other women at most parities, but this may reflect the length of time to the last birth rather than having another birth.

7 CONCLUSION

Despite its location on the other side of the world, the 19th century fertility transition occurred in Tasmania at around the same time as in other English-speaking countries and most Western European countries. The historical fertility transition in Tasmania also showed remarkable similarities with the fertility transitions in the other countries.

In Tasmania, fertility fell mainly due to the practice of stopping behaviour, which was an 'innovative' form of behaviour adopted by couples in order to control the size of their families. 'Spacing' behaviour played only a very small part in the fertility decline.

In relation to reasons as to why fertility fell at this time, both 'innovation' and 'adjustment' factors played a role in the fertility decline. Tasmania was undergoing a period of social and economic transformation in the last decades of the 19th century. Opportunities for social and economic mobility were an important part of this transformation. The upper and middle classes were the first to limit the size of their families, followed by the other classes, with unskilled workers and farmers being last to adopt fertility control. Couples in the urban areas had significantly lower fertility than those in the rural areas, even before the fertility transition.

Tasmania was a relatively secular society in the late 19th century, conditions which were favourable to the acceptance of ideas about fertility control. Unlike other countries, there were no significant differences between religious groups in the extent to which they practised stopping behaviour, although there were some differences in the practise of 'spacing' behaviour.

Communication within Tasmania, with other colonies and with other countries, improved markedly from the 1870s onwards. Written material about fertility limitation became available in the Australian colonies from overseas around the same time. Improvements in education had opened up people's minds to these new ideas and allowed them to access the information.

In conclusion, fertility declined in Tasmania in a period of social and economic transformation in which new ideas and information became accessible to a population that was highly motivated to accept these ideas and to adopt innovative fertility control practices.

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Appendix tables

Table A1 Proportion of families by number of children, complete group: 1860, 1870, 1880 and 1890 marriage cohorts, Tasmania.

	1860	1870	1880	1890
Number of children	Per cent			
1-3	14.5	14.1	14.6	27.6
4-6	20.7	18.0	30.2	37.6
7-9	29.7	30.4	32.1	23.3
10+	35.2	37.5	23.0	11.5
Total (per cent)	100.0	100.0	100.0	100.0
Total (no.)	256	283	417	529

Back to page 126.

Table A2 Parity progression ratios, complete group: 1860, 1870, 1880 and 1890 marriage cohorts, Tasmania.

	1860	1870	1880	1890
Parity i	Parity progression ratios (i, i+1)			
One	0.9531	0.9541	0.9784	0.9528
Two	0.9590	0.9593	0.9559	0.8950
Three	0.9359	0.9382	0.9128	0.8496
Four	0.9543	0.9465	0.9045	0.8229
Five	0.9091	0.9348	0.8292	0.7373
Six	0.8737	0.8930	0.8614	0.7940
Seven	0.8675	0.8490	0.8043	0.7514
Eight	0.7917	0.8221	0.7892	0.6906
Nine	0.7895	0.7910	0.6575	0.6458
Ten	0.6667	0.6887	0.5729	0.7258
Eleven	0.7167	0.6301	0.6364	0.4667
Twelve	0.6047	0.5217	0.5429	0.4762
Thirteen	0.3462	0.5417	0.6316	0.6000
Fourteen	0.4444	0.4615	0.5833	0.6667
Fifteen	0.0000	0.3333	0.1429	0.0000
Sixteen	..	0.0000	0.0000	..
Total families (no)	256	283	417	529

Note: '..'= not applicable

Back to page 126.

Table A3 Proportion of women reaching each parity: 1860, 1870, 1880 and 1890 marriage cohorts, Tasmania.

	1860	1870	1880	1890
Parity i				
One	1.000	1.000	1.000	1.000
Two	0.953	0.954	0.978	0.953
Three	0.908	0.915	0.935	0.853
Four	0.850	0.859	0.854	0.725
Five	0.811	0.813	0.772	0.596
Six	0.738	0.760	0.640	0.440
Seven	0.644	0.679	0.553	0.350
Eight	0.559	0.576	0.444	0.262
Nine	0.443	0.474	0.350	0.181
Ten	0.349	0.375	0.230	0.117
Eleven	0.233	0.258	0.132	0.085
Twelve	0.167	0.163	0.084	0.040
Thirteen	0.101	0.085	0.046	0.020
Fourteen	0.035	0.046	0.029	0.011
Fifteen	0.016	0.021	0.017	0.008
Sixteen	0.000	0.007	0.002	0.000
Total families (no)	256	283	417	529

Continued on page 127.

Table A4 Distribution of covariates for logistic regression (Table 2).

Covariate	**No. of births**	**Per cent**	**Covariate**	**No. of Births**	**Per cent**
Mother's age at the birth			Type of geographic location		
<25 years (ref.)	2,416	24.0	Urban area in Tasmania (ref.)	2,773	27.5
25-<30 years	2,663	26.4	Rural area in Tasmania	6,376	63.2
30+ years	4,970	49.3	Another colony	937	9.3
Missing	37	0.4	Religion		
Mother's age at marriage			Anglican (ref.)	3,634	36.0
<20 years (ref.)	3,743	37.1	Catholic	1,194	11.8
20-<25 years	4,834	47.9	Presbyterian	1,381	13.7
25+ years	1,472	14.6	Methodist	2,170	21.5
Missing	37	0.4	Other Nonconformist	1,701	16.9
Age difference between couple			Missing	6	0.1
Same/ Husband up to 5 yrs older (ref.)	4,432	43.9	Literacy status of husband and wife		
Wife older	1,416	14.0	Both literate (ref.)	8,483	84.1
Husband 5+ years older	4,100	40.7	Husband and/or wife illiterate	1,603	15.9
Missing	138	1.4	Twin birth	99	1.0
Marriage cohort			Child dies as infant before conception of another	620	6.2
1860/70 cohorts (ref.)	4,215	41.8	Family composition		
1880 cohort	2,921	29.0	More girls than boys	3,917	38.8
1890 cohort	2,950	29.3	More boys than girls	4,413	43.8
Socioeconomic status			Equal numbers of boys and girls	1,756	17.4
White-collar (ref.)	1,862	18.5			
Skilled	1,460	14.5	Total births=10,086		
Farmers	2,861	28.4			
Lower skilled	1,068	10.6			
Unskilled	2,806	27.8			
Missing	29	0.3			

Back to page 128.

Table A5 Proportion of women who have at least a specific number of surviving children, complete group: 1860/70, 1880 and 1890 marriage cohorts, Tasmania.

No. of surviving children	**1860/70**	**1880**	**1890**
One	1.000	1.000	1.000
Two	0.953	0.935	0.905
Three	0.898	0.861	0.801
Four	0.835	0.780	0.692
Five	0.764	0.691	0.580
Six	0.686	0.597	0.470
Seven	0.602	0.501	0.366
Eight	0.514	0.406	0.272
Nine	0.426	0.316	0.192
Ten	0.340	0.236	0.128
Eleven	0.260	0.167	0.080
Twelve	0.190	0.111	0.046

Back to page 130.

Table A6 Distribution of covariates for survival analysis (Table 3).

Covariate	No. of births	Per cent	Covariate	No. of Births	Per cent
Mother's age at the birth			Type of geographic location		
<25 years (ref.)	2,359	27.4	Urban area in Tasmania (ref.)	2,310	26.9
25-<30 years	2,511	29.2	Rural area in Tasmania	5,537	64.4
30+ years	3,702	43.0	Another colony	754	8.8
Missing	29	0.3	Religion		
Mother's age at marriage			Anglican (ref.)	3,105	36.1
<20 years (ref.)	3,305	38.4	Catholic	1,032	12.0
20-<25 years	4,105	47.7	Presbyterian	1,161	13.5
25+ years	1,162	13.5	Methodist	1,867	21.7
Missing	29	0.3	Other Nonconformist	1,431	16.6
Age difference between couple			Missing	5	0.1
Same age/husband up to 5 yrs older (ref.)	3,785	44.0	Literacy status of husband and wife		
Wife older	1,174	13.7	Both literate (ref.)	7,196	83.7
Husband 5+ years older	3,529	41.0	Husband and/or wife illiterate	1,405	16.3
Missing	113	1.3	Twin birth	72	0.8
Marriage cohort			Child dies as infant before conception of another	522	6.1
1860/70 cohorts (ref.)	3,676	42.7			
1880 cohort	2,504	29.1	Family composition		
1890 cohort	2,421	28.2	More girls than boys	3,317	38.6
Socioeconomic status			More boys than girls	3,760	43.7
White-collar (ref.)	1,510	17.6	Equal numbers of boys and girls	1,524	17.7
Skilled	1,235	14.4			
Farmers	2,482	28.9	Total birth intervals=8601		
Lower skilled	887	10.3			
Unskilled	2,461	28.6			
Missing	26	0.3			

Back to page 132.