Marriage markets and fertility in South Africa with comparisons to Britain and Sweden

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MARRIAGE MARKETS AND FERTILITY IN SOUTH AFRICA WITH COMPARISONS TO BRITAIN AND SWEDEN

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MARRIAGE MARKETS AND FERTILITY IN SOUTH AFRICA WITH COMPARISONS TO BRITAIN AND SWEDEN

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Preface

This is always a very difficult part because so many people have helped in so many different ways. Nonetheless, there are those that should be recognized for the critical help they have provided. I thank Almighty God for having given me the strength and ability to achieve this goal and giving me understanding when I asked, *Temesgennnnn*.

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Special thanks to Marcos Ribeiro-Poplawski, Naomi Leefmans, Eiko Kenjoh, Massimo Giuliodori, Cecile Wetzels, Emily Gustafsson-Wright, Ana Llena Nozal, Fern Terris-Prestholt and Abay Mulatu who have been given me encouragement and friendship during my stay in the Netherlands. The true support and friendship of Debora Kusmerski and Sandra Maximiano were critical for me to believe in myself and I am especially thankful to Sandra for the work ethics and stimulating conversations she shared with me.

Special thanks to my beautiful sister Selam Yergou (fondly a.k.a *Lidjet*) for being my paranimf and an excellent host whenever I was in the Netherlands. Selam not only cooked for me but also did my laundry and kept me constantly entertained. Thanks once again for spoiling me rotten. I am thankful to my sister Martha Yergou for the keen interest she showed in the progress of my studies and the regular messages of support and long distance telephone calls. Also special thanks are owed to my mother W/ro Nigatua

WoldeYohannes who always encouraged us to study and excel in life; to the rest of the family for being supportive and proud of my achievements, *keff yale mesgana ke akberot gara.*

I am grateful for the support received from colleagues from Statistics South Africa, especially for Akiiki Kahimbaara for reassuring me that nobody is too old for doing a PhD; for Ros Hirschowitz and Pali Lehohla for approving my leave of absence during the period of my studies; for Jacques de Klerk for taking care some of the work and sparing me the additional stress it could bring; Khuliliwe Kunene for keeping me updated about activities around the office; for Jane Mogoboya and Diane Blades for all entertaining email and text messages and occasional phone calls. I also thank Christian Family Church and especially the pastors Bernard Mulder and Lynn Human, for providing me comfort and counseling during some of the most stressful period of my life.

Last but not least, I owe a huge debt to my husband Zeleke Worku for being there for me from the beginning to the end of my studies; for his daily emails of encouragements; for his weekly phone calls; for taking good care of our daughter while I was away; to have been a shoulder to cry on when progress was slow and to have been a pal to celebrate with when things are working out and amongst all I am appreciative for the financial support he gracefully provided during my studies. Special commendation and boundless appreciation and affection to my adorable little girl Edna for putting up with her absent mother during what seems to her and this author a never-ending process, *Egziyabeher yebarkesh*.

It has been interesting to live in Europe in the midst of its identity crisis, where discussions are usually centered on multiculturalism, cultural integration and how to maintain a society united in its diversity. Being a European citizen in the 21st century is certainly unique but having been there at the time is by itself an experience that I wouldn't trade for anything else. I however have mixed feelings about living in the Netherlands. I will certainly miss the sights and sounds, the peace and quiet and the extreme sense of safety I always felt strolling through the narrow streets or along the canals of Amsterdam at odd times. Yet it is usual after a short stay that I longed to always return to the authentic warmth and liveliness of my African brothers and sisters.

Amsterdam October 2007,

Seble Worku- Yergou Belay

To my daughter, Edna
My mother, Nigatua.

"Never regard your study as a duty, but as the enviable opportunity to learn to know the liberating influence of beauty in the realm of the spirit for your own personal joy and to the profit of the community to which your later work belongs." Albert Einstein

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Chapter 1

Introduction

1.1 Background of the dissertation

Marriage and fertility have been analysed in a micro-economic framework from the concepts developed by Mincer (1962), Becker (1965) and Willis (1973). The concepts were formally formulated in the seminal work by Becker "A theory of Marriage: Part I and Part II". He wrote:

> "Two principles form the heart of this analysis. The first is that since marriage is practically always voluntary either by the persons marrying (or their parents), the theory of preferences can be readily applied and, persons marrying (or their parents) can be assumed to expect to raise their utility level above what it would be were they to remain single. The second is that, since many men and women compete as they seek mates, a market in marriages can be presumed to exist. Each person tries to find the best mate subject the restrictions imposed by market conditions".

Becker uses the marriage market theory to analyse who marries whom, when and why. His opinion is that marriage occurs only if they are profitable to both parties involved. Becker explains that marriage markets are markets where husbands and wives supply their spousal services. Since individuals participating in these markets are assumed to behave rationally and to use cost-benefit analysis to decide on their behaviour, they maximize their own utility. Men and women select each other in such a way that the outcomes of all goods produced by all families are maximized overall marriages. Thus positive assortative mating with respect to education, physical features, age, religion or ethnicity takes place when spouse characteristics complement each other. Becker predicts negative assortative mating by substitute traits such as wages and hours worked.

The sex-ratio at birth is the ratio of the number of boys born to the number of girls born and is normally equal to 105 (e.g. it is 102 for South Africa, 105 for the United Kingdom and 106 for Sweden[1]). Imbalances can arise in the marriage market as a result of pure demographic effect where sex-ratios are higher or lower from 100. Also imbalances can be the result of the quality of the marriage market with lack of attractive mates. In such situations, optimal matching is still achieved although it may not be the best desired outcome for all involved since it can result in single motherhood or childlessness.

Becker's fertility theory implies decisions about when to have children and how many although made jointly by the couple or made independently by individuals, are decisions both based on income and price. His proposition of fertility theory is what Becker refers to the quality-quantity trade off. He wrote:

> "Children are usually not purchased but are self-produced by each family using market goods and services and parents own time, especially of mothers. Since the cost of own time and household production function differ among families, the total cost of producing and rearing children differs".

He refers to children as "normal goods" and thus although his theory would infer that higher income people would purchase more children as if they were relating to other consumer goods, this, in real life doesn't happen. Instead, higher income people have fewer but more expensive children since higher income for either the man or the woman would allow parents to invest more in the child in the form of human capital or money transfer. But higher women's wages also increase the opportunity cost of their time, inducing women to seek a reduced family size. It is thus necessary to also look at the socio-economic variables and public policies that can influence the fertility decision.

Becker's pioneering work generated a wealth of empirical work. Studies range from consequences of marital patterns on fertility and inequality in family, to fertility and labour market position, fertility and human capital decision. Empirical studies suggest that timing of fertility is strongly linked to human capital accumulation. Women who have children in their teenage age have less opportunity to develop human capital. Women who pursue higher education would postpone childbearing and with a rise in the return to education and experience women tend to further delay fertility or to decide to remain childless.

1.2 Research questions

This dissertation focuses on both issues of the marriage market and fertility comparing South Africa to the United Kingdom and Sweden. The choice of the three countries may be uncertain and need to be clarified. Although both Sweden and the United Kingdom are European countries, differences in policies pursued by the Swedish and the United Kingdom governments have resulted in different societies involving population ageing,

[1] 2005 value for South Africa, Statistics South Africa; 2006 values for the United Kingdom and Sweden, United Kingdom Office for National Statistics Sweden.

non-marriage and childlessness. Both governments have taken action to remove obstacles that discourage women wishing to have children from doing so, because of the negative economic consequences of childbearing and of the length of the associated responsibilities. However the level of incentives is different. For example Swedish fertility was higher a few years ago compared to the United Kingdom due mainly to the introduction of child friendly and generous public policies earlier. These policies promote not only availability of affordable full-time day care centers and paid parental leaves but also equal labour market opportunities by way of separate individual taxation and affirmative action policies towards women. By contrast, childcare reforms took place in the United Kingdom only in the late 1990s with the government providing financial support to parents in the form of childcare tax credit with the aim of encouraging mothers to work while using formal childcare. The reform also includes the extension of paid maternity leave from 6 to 12 months. However both Sweden and the UK have currently failed to achieve replacement level total fertility rates. These two countries are analysed in chapter 2 with the core of the research question being: What factors lead to assortative mating and what are the implications of such pairing for age at union formation and first birth?

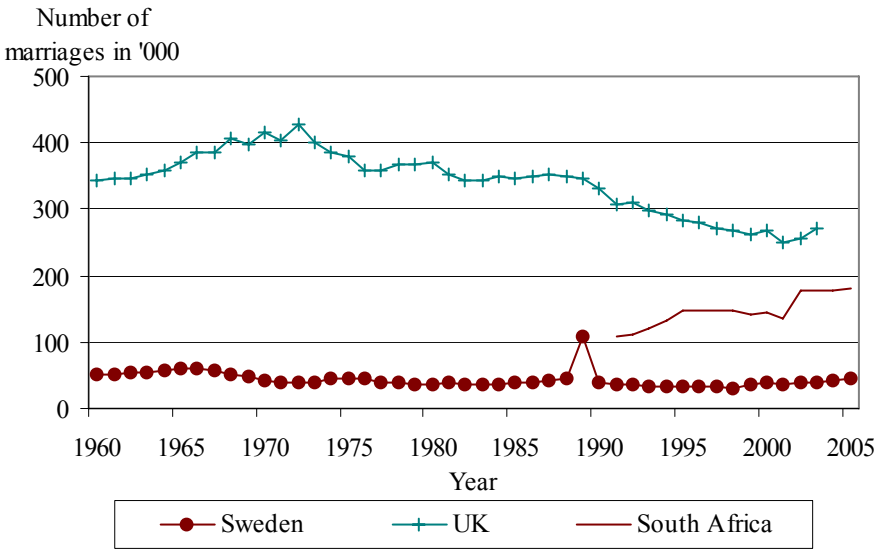
Figure 1.1 presents the number of marriages in the three countries. Unfortunately data for South Africa is only available from 1991 onwards because marriages among Africans were not recognized by the government of the day and thus were not officially recorded. In the United Kingdom, marriages rates peaked in the 1970s and have since fallen by about half. Compared to the 1960s, in the United Kingdom, there are currently 27% fewer marriages. In Sweden, marriages rates have been steady except for the dramatic rise in 1989 in response to the abolishing of the widow's pension from January 1990. Under the new legislation, only persons who were born before 1944, were legally married by December 1989 and had children still qualified for the pension. The dramatic increase from 40,000 to 112,000 marriages was because of marriages between couples who were living in consensual unions hoping to qualify for the pension.

Marriage rates in South Africa are slowly rising, but still very low. For example, the number of women who got married in 2001 were 134, 581 whereas the census registered 6.9 million never married women aged 16 and more in 2001. This translates to only 2% of these women being married. The low number of marriages is associated with changing patterns of family formation type, marriages being more and more replaced by cohabitation and out of wedlock childbearing being more acceptable. In South Africa, marriage among Africans is much lower compared to the other population groups[2] and our hypothesis is that low sex ratio among this population group is responsible for the lower marriage rates among Africans. Indeed according to census 2001, there are 1.6 million fewer African men than women among all age groups. The above considerations led to the following research questions in chapter 3: Is the shortage of marriageable men the reason

[2] The proportions of each group in 2001 were: African 79%; Coloured 9%; Indian 2% and White 10%. The apartheid terminology is still used for monitoring reasons although people are self-classified as to population group.

for low marriage rates among African South African mothers? Would women more likely accept less desirable forms of marriages (polygamous marriages or cohabitation) given a low sex ratio?

Figure 1.1: Number of marriages from 1960-2005



Sources: Statistics Sweden, Population and population changes in Sweden, 2006; UK National Statistics Office, Marriages, age and previous marital status for England and Wales, 2006; Statistics South Africa, Marriages and divorces, P0307, 1996-2005.

Table 1.1 depicts the educational attainment by population group and gender in South Africa for 1960 and 2001. One can see a dramatic growth in educational attainment in the 40 years from 1960 to 2001 for all population groups. The most striking is among Africans, the majority having at least achieved some secondary education whereas in 1960 close to 13 out of 20 Africans did not have any schooling. Also Indians have done extremely well moving from only 2% having a higher education in 1960 to 15% having a higher education in 2001 which is an increase of 700%. The gender gap in educational attainment is not as large as is the case in other developing countries. In 2001, 16% of men and 20% of women have no education and 30.2% of men and 27.7% of women have at least high school education. By contrast, in Nigeria, in 2003, 31% of men and 46% of women have no education and 16% of men and 10% of women have at least high school education (National Population Commission and ORC Macro, 2004). According to human capital theory fertility will decrease as women's education increases.

With rising mortality due to AIDS and related diseases and the increase in orphanhood, current government policies in South Africa strive to replicate European type welfare to alleviate child poverty and protect vulnerable families. In the past, social

security was provided to the White population only. In 1997, the government introduced the Welfare Laws Amendments Act to amend the Social Assistance Act of 1992, so as to provide uniformity and equality of access to social assistance throughout the country. Also the Act makes provision for the effective regulation of social assistance and introduces the child-support grant. The Maintenance Act is passed in 1998. The Act recognizes the right of every child to a standard of living which is adequate for the child's physical, mental, spiritual, moral and social development and is passed in order to take all appropriate measures to secure the recovery of maintenance for the child from the parents or other persons having financial responsibility for the child (Government Gazette, 1997; 1998b).

Table 1.1: Increase in education level in South Africa from 1960 to 2001

	No schooling	Some/complete primary	Some secondary	Complete high school	Higher education
Census 1960					
African	65.2	31.2	2.6	0.1	0.8
Coloured	35.0	56.9	5.8	0.5	1.8
Indian	33.7	55.5	7.2	1.6	2.0
White	2.2	31.8	37.2	13.9	14.8
Female	48.0	34.4	11.1	3.1	3.4
Male	47.8	34.1	10.1	3.4	4.7
Total	47.9	34.2	10.6	3.2	4.0
Census 2001					
African	22.3	25.4	30.4	16.8	5.2
Coloured	8.3	28.2	40.1	18.5	4.9
Indian	5.3	11.9	33.0	34.9	14.9
White	1.4	2.0	25.9	40.9	29.8
Female	20.0	21.9	30.4	19.5	8.2
Male	15.5	23.0	31.3	21.5	8.7
Total	17.9	22.4	30.8	20.4	8.4

Source: Census 1960, 2001

However apart from stating that parents should support all their children equally irrespective of their birth order, whether born in marriage or out of wed-lock, the law is not specific about the role of both parents. Also the government has done little in the enforcement of the law and thus children have little or no access to their father's assets if not living with him or they can only successfully have access to their father's assets if the father is married to the mother of the child. In addition, government social assistance exists in the form of a child support grant. The grant is intended for the support of poor children. It was initially awarded to parents of children under age 7 and was later extended to children of 14 and below. It is means tested and is paid to the primary care giver of the child. It amounts to R180 per child starting from April 2005 (Department of Social Development, 2003; Manuel 2005). With high unemployment rate and no other means of support to unemployed women, there is a concern that this grant gives incentive to bear children especially among teenagers. This concern parallels the one raised many years ago

in the US that the Aid to Families with Dependent Children (AFDC) does not promote work and that it is responsible for the expansion of out-of-wedlock childbearing (Moffit, 1992)[3]. This has prompted the United States government to substitute the AFDC by the Earned Income Tax Credit (EITC) for which only working families qualify.

Government involvement in providing childcare for younger children is non-existent in South Africa. Parents are responsible for finding day care and financing the earning loss incurred by time spent on caring for children. In big cities and townships, affordable good childcare services are readily available because of the large supply of domestic servants from among women who have no skills for other jobs in the labour market. Domestic childcare can be secured at highly reasonable price; there is even a downward pressure from Zimbabwean women coming into the country. The latter also applies to rural commercial farm areas. In rural tribal areas which largely consist of the former homeland areas on the other hand, childcare facilities are not available. Extended family members, mostly grandparents, aunts or older siblings, look after children.

Total fertility rates (TFR) can be used as an estimate of the fertility growth factor in a population, e.g., whether the childbearing population is replacing itself or not. A TFR of 2.1 indicates that couples are producing two children to replace themselves and is dependant on the life expectancy of the population because replacement actually occurs when the child is aged 15. Thus demographers have recently pointed out that the replacement level TFR differs by countries and is much higher than the 2.1 level for countries with higher mortality rates since some will not reach adulthood (Espenshade et al, 2003). Engelman and Leahy, 2006 estimate the replacement level TFR for South Africa at 2.57.

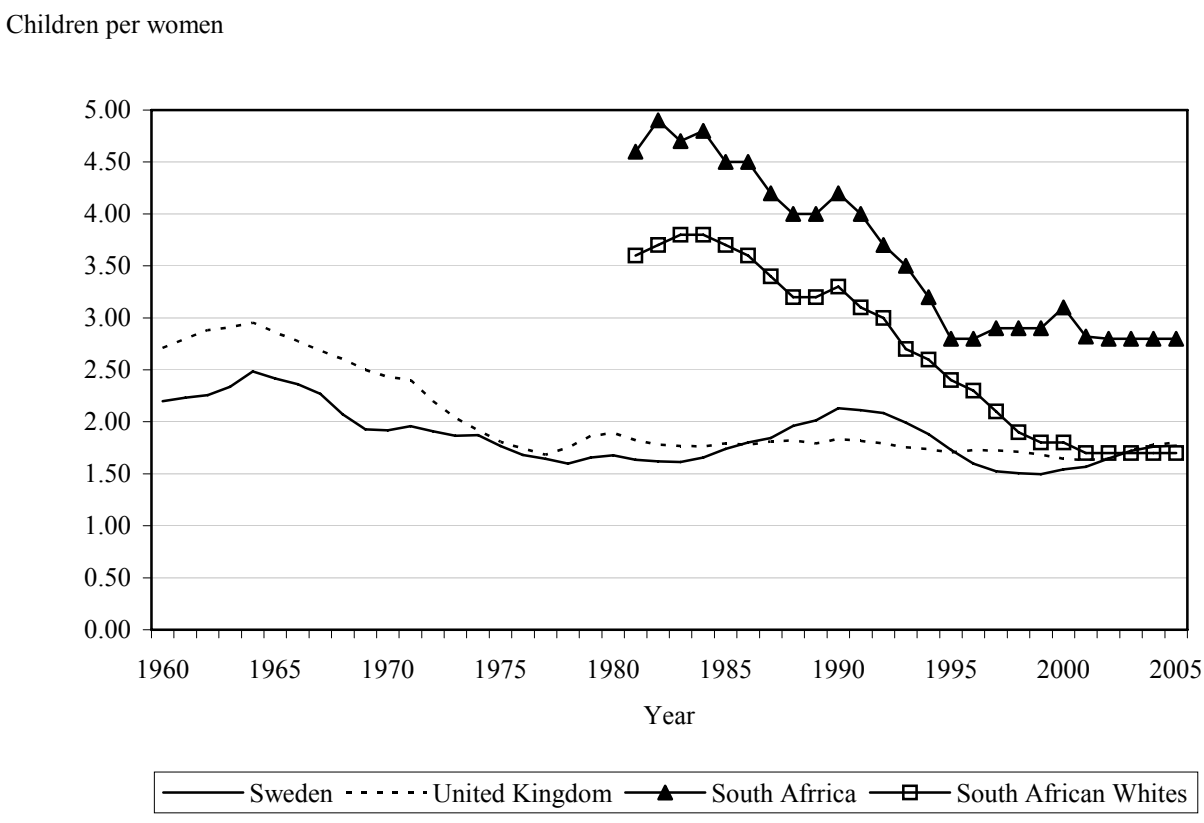
In Figure 1.2 are presented TFR for Sweden, the United Kingdom and South Africa. In addition, the TFR for White South Africans are compared to the two European countries. Although South Africa is a developing country, fertility rates are declining very rapidly. These have been attributed to the rise in education, rapid urbanization of the country, higher access to contraceptives and the high HIV prevalence in the country, which continues to spread due to unprotected teenage sex which also contributes to the high teenage birth rate.

Swedish and British TFR have been under 2.0 since the early 1970s and slightly picked up in the 1980s but only fluctuating between 1.5 to 2.0. The total fertility rate in South Africa declined from an estimated 4.6 in 1981 to close to 2.8 in 2005. One can observe the decline in the rates for White South Africans to be quite extreme since it has reduced by half in 20 years and is currently at the same level as the two European countries. This similarity in the fertility behaviour does not really imply similarity in labour market, human capital investment and behaviour in the marriage market. In chapter 4, we analyse what determine fertility dynamics in South Africa. The research attempts to identify the effects of education by population group on the number of births and the timing of birth.

[3] The Aid to Families with Dependent Children (AFDC) consists of cash benefits to families with incomes low enough to qualify. The state determines eligibility and the amount of the benefit. See Chapter 3.

In the 1990s, the United Kingdom the highest teenage fertility compared to all other western European countries with for example a teenage fertility of 31.7 per 1,000 women in 1992, which represents a level six times that of Sweden. Worries of long-term consequences for teenage mothers has resulted in research as suggested by the literature, about the United Kingdom among others recently by Ermisch and Pevalin (2003, 2005), the United Kingdom government introduced programs for improvements in sex education, contraceptive services, and support for pregnant teenagers as well as teenage mothers. The campaign aims to halve the rate of teenage pregnancy in the UK over the next 10 years. However although there is a decrease in the rate, it is still high and total fertility rates are still very low. In chapter 5, we analyse whether or not teenage motherhood in South Africa lead to adverse future outcomes. The rest of this chapter presents an overview of how the dissertation is structured to answer the research questions raised above.

Figure 1.2: Total fertility rates from 1960-2005



Source: Council of Europe: Demographic yearbook 2003; http://www.coe.int/population Sibanda and Zuberi p.71 (The Demography of South Africa); Mid-year population estimates 2004; 2005, Stats SA. Note: National values for 1997, 1998 and 1999 were imputed.

1.3 Outline of the dissertation

The thesis has six chapters. The second chapter focuses on duration until couple formation and first birth in Britain and Sweden. We analyse couples who have experienced both events. We estimate a model of timing of union formation and first birth by distinguishing between different combinations of educational grouping of Swedish and British couples born 1930-1979. In a first step, which represents the mating function, we estimate a spouse choice equation based on individual human capital and family of origin characteristics as well as marriage market indicators, using a multinomial logit model. The results show that there is assortative mating by education where most people form a union with somebody who has a similar education level as themselves. We create nine educational categories using predicted probabilities of marital sorting given the individual education level and other background variables. In a second step, we estimate the rates of union formation and first birth using Weibull hazard models with individual unobserved heterogeneity, predicted educational categories and other fixed and time varying variables serving as explanatory variables.

The third chapter studies the effects of local marriage markets on South African women's marital decisions. The analysis is motivated by the low proportion of married among African mothers since 48% are never married nor living in consensual unions. This means the children of all these never married mothers have no access to their father's resources. The low sex ratio of 92 men to 100 women among Africans aged 20-40 makes us believe that shortage of marriageable men may explain marriage patterns. Economic theory predicts less attractive marital outcomes for women when the sex ratio is low. We analyze this hypothesis using the 2001 census of South Africa. We think that other things equal a mother with a child would rank marriage alternatives in the following way from less desirable to more attractive- never married, unmarried cohabitation, polygamous marriage and civil marriage. The observation that close to 50% of mothers have chosen to be in the less desirable state is because her utility maximization does not make better alternatives other things being equally available to her. An ordered probit model is fitted with the different marital type ranked from less desirable (never married) to more attractive (married civil).

Although fertility has reduced by almost half in two decades the relative differences between population groups, however, remain as large as ever; 1.7 among Whites, 1.9 for Indians, 2.3 for Coloured and 3.0 for Africans. The objective of the fourth chapter is to obtain insights in how education policies aimed at African and Coloured women achieving higher educational attainment may close the fertility gaps between the population groups. For this purpose we analyse to what extent differences in women's education explain the large differences between population groups in the timing of births and completed fertility using the 2002 General Household Survey data. We estimate multi-spell duration models of waiting time to first and higher order of births. We then determine lifecycle fertility pattern by Monte Carlo simulations.

In the fifth chapter, using the same data set as in chapter 4, we study teenage childbearing and a number of outcomes in 2002 such as completing high school and satisfaction with life. Teenage motherhood is high in South Africa on a level similar to that of the United States and Brazil but lower than in other Sub-Saharan countries. In 2001, 55 per thousand African South African women and 82 per thousand Coloured South African women were teenage mothers as compared to 8 among Indian South Africans and 3 among White South African women. We estimate a two stage least square (2SLS) model on the joint determination of the probability of teenage motherhood and completing high school, identifying by abortion rates, the numbers of doctors and nurses by region and the distance to the nearest clinic. The dissertation is concluded in chapter 6, which provides an overview of the results and some policy recommendations.

Chapter 2

Education, Assortative Mating and the Duration to Couple formation and First Birth in Sweden and Britain

2.1 Introduction

The purpose of this chapter is to analyze whether the effect of longer education on timing of maternity works primarily through the timing of couple formation or through postponement of maternity once the couple is formed. We consider the effects of education of each spouse together and separately on postponement of couple formation and the time elapsed from couple formation to timing of first birth.

In Western Europe, the period spent in education has increased over time, and fertility is very low. A number of studies, including Gustafsson, Wetzels, Vlasblom and Dex (1996) and Kenjoh (2004), show that relative to mothers in Britain, Germany and the Netherlands, Swedish mothers are much more likely to have entered employment within 24 to 60 months after first birth. This difference may be explained by the Swedish policies of paid parental leaves, subsidized childcare, and separate taxation of earnings, which have been effective in Sweden since the early 1970s. These policies are intrinsically pronatalist.

This chapter is published in Review of the Economics of the Household, 2005, Vol.3 No.1 pp.91-113 and as chapter 11 in Gustafsson S.S and Kalwij A. (eds.), 2006. Seminar participants at the Scholar seminar October 2004, University of Amsterdam; seminar participants at the University of Groningen; seminar participants at the University of Lund and conference participants at the European Society for Population Economics (ESPE) 2004 are thanked for useful comments.

One purpose of this chapter is to analyze whether in Britain, where family policies are much less generous and reforms in this area have been introduced only since the 1990s, duration to first birth is longer relative to Sweden.

Our theoretical conception is that individuals have a preferred age for couple formation and timing of birth that fits their human capital investment plans. They also have a fair idea of desirable traits for the marriage candidate when searching in the marriage market. The timing of union formation depends not only on the successful completion of human capital investment but also on the successful search for the right candidate. In our empirical work, we adopt a two-stage method of estimation. We first determine who marries whom by a multinomial logit model and then use predicted probabilities of the spouse's education level in hazard models to analyze the duration from age 13 to union formation and the duration from union to first birth.

The outline of this chapter is as follows: section 2.2 discusses the theoretical framework, section 2.3 gives a descriptive country comparison, section 2.4 motivates the empirical strategy, section 2.5 presents estimates of the mating function, section 2.6 presents the results on the durations to couple formation and first birth, and section 2.7 concludes.

2.2 Theoretical considerations and earlier work

There are two basic questions addressed in this chapter: 'Who marries whom?' and 'What causes postponement of couple formation and first birth?' Becker (1973, 1981) suggested that if an attribute complements a similar attribute in a partner, this leads to positive assortative mating: 'likes' marry 'likes'. Spouse's education is most likely complementary, so that a highly educated person profits from marrying someone with a similar education. Evidence of positive assortative mating by education has been found for the United States (Mare, 1991) as well as for many European countries (Blossfeld and Timm, 2003). However, education can have the opposite effect: if sex ratios of highly educated people diverge from unity a less educated woman may marry a man with a higher education than her own because he can't find a highly educated available candidate at the optimal time of couple formation, or vice-versa. Search on the marriage market may also take longer.

In Blossfeld and Timm (2003), which has inspired our thinking on the mating function, the focus is on explaining 'upward marriage' as opposed to 'homogamous marriage' and 'downward marriage' with regard to educational attainment levels of men and women. The same structure of analysis is used in Blossfeld and Timm (2003) for all 14 countries included in their analyses[1]. For example, in Germany older cohorts of women married upwards because the educational sex ratios of these cohorts were favorable for upward marriage.

In general, results show that successful search in the marriage market depends on the availability of marriage candidates or sex ratios (see Grossbard-Shechtman 1984, 2003;

[1] Countries included in the Blossfeld and Timm (2003) are: West Germany, Flemish Belgium, France, the Netherlands, Italy, Spain, Great Britain, United States, Denmark, Sweden, Hungary, Slovenia and Israel.

Lam 1988; Bergstrom and Lam 1989; Bergstrom 1997; Ono 2002). Furthermore, Ermisch (2003), citing Burdett and Coles (1997, 1999) presents a theory of search in the marriage market, where the probability of matching with someone of lesser quality, for example lower education, depends on the offer arrival rate, the proportion of others with higher education in the marriage market, the probability of divorce, the personal discount rate, and the expected life-time discounted values of marrying a highly educated person versus staying single or marrying a less educated person.

Theories of search in the marriage market and assortative mating take optimal age at couple formation as exogenous. For example, Bergstrom and Lam (1989) and Bergstrom (1997) assume that men prefer to marry a woman three years younger and they exploit the large year to year variation in Swedish fertility rates for empirical estimation of their model[2]. However, empirical results show that women postpone motherhood until after finishing education, e.g. for Germany, Blossfeld and Huinink (1991) show that the probability of marrying or having a birth is very low for women who are students. Similar results are found for Britain, Germany, the Netherlands, and Sweden in a cross-country analysis on the role of education in postponement of maternity (Gustafsson, Kenjoh and Wetzels, 2002a).

It seems reasonable to think of optimal age at union formation and optimal age at first birth as the outcome of a plan for investments in human capital and career planning (see Gustafsson, 2001). With this approach it becomes important to study consequences for lifetime earnings of different timing of first birth, as is theorized in Cigno (1991, chapter 8) and Gustafsson and Wetzels (2000). One can think of optimal age at first birth as a financial constraint. Seeing this decision from a man's point of view, career planning and ability to provide financially for a family would not give different results for optimal timing. For a woman, who in most cases has to carry most of the time costs of children, the career planning motive can lead her to postpone first birth beyond the point that would suit a husband who is two years older and more financially secure. For a woman it may be optimal to delay motherhood until her opportunity costs of childcare in terms of her career have decreased, leading her to first complete her education and establish herself on the job market. Formally, timing of first birth depends on the opportunity cost of time, plus the foregone human capital cost. The opportunity cost of time consists of wage multiplied by periods not worked in the labor market due to childcare requirements. The capital cost consists of human capital investments foregone multiplied by the forgone returns to human capital investments due to the child's presence. The optimal timing then maximizes lifetime earnings or equivalently minimizes the opportunity cost plus the capital cost (Cigno, 1991, chapter 8; Gustafsson, 2001).

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[2] Bergstrom and Lam (1989) estimate this model on Swedish birth cohorts of men born from 1895 to 1942 and women born from 1898 to 1945. They assume that the difference $a_m^* - a_f^*$ is 3 years, so that a man always wishes to be 3 years older than his wife. According to this assumption the deviation of the marriage age from the preferred marriage age of a male will depend on the availability of women three years younger. Because of period fluctuations in the total fertility rates the sex ratio Mt/F_{t+3} fluctuated in their study between 0.9 and 1.25.

The time costs of marriage, even if not zero, are likely to be much smaller than the time costs of caring for a small child. Due to the availability of reliable contraception the two decisions can be separated and the explanatory variables can have different effects on timing of couple formation and timing of first birth. We therefore develop the analysis as two separate decisions.

2.3 Descriptive country comparisons

We use several waves from the British Household Panel Survey (BHPS) for the years 1991-1998 for Britain (Taylor 1999) and the Household Market and Non-Market Activities Survey (HUS) covering the years 1984-1998 (Klevmarken and Olovsson, 1984), which is a similar household panel survey for Sweden.

Our analysis is performed on the select sample of couples who had at least one child by 1998, the woman having been born between 1930 and 1979. Our sample makes use of information on both husband and wife. We treat unmarried cohabitation as equivalent to marriage. The data sets provide information on year of birth and education completed by both husband and wife. The data also provide complete fertility history and information as to when the couples moved in together (collected in waves 2 and 8 for the British data and using the full panel for the HUS). Women or men for whom we could not match the natural father or mother of the first child, or with other missing values, were discarded. Our sample consists of 3,072 couples (1,960 cases for Britain and 1,112 for Sweden).

Education is a key variable. In our data we know the highest education level achieved by the individual. The philosophy behind making educational levels comparable across countries has been to determine the level of education corresponding to the US 'high school' and call that medium education, whereas less education than what corresponds to 'US high school' is called low education and more than 'high school' is called a high level of education. Implementing this rule we defined medium education level as that normally taking 12-14 years of fulltime study. We use the average time it takes to achieve the education level given in the data to determine whether an education is high, medium or low. (The education variable was developed for earlier cross country comparative work by Gustafsson and co-authors, see Wetzels (2001) and Kenjoh (2004) for further details on this variable).

In Table 2.1 we compare the mean age at the life events of women in couples. Swedish women are on average older at finishing education and union formation than their British counterparts but younger at first birth for a given education level: British couples, where both husband and wife have higher education, while younger at couple formation are almost two years older at the birth of a first child. Looking at the age differences between partners, women in both countries form unions with partners 2 to 3 years older than themselves with the exception of highly educated Swedish women married to less educated men who are 3.6 years older than themselves.

Table 2.1 also demonstrates that there is educational assortative mating in both countries. The proportions are similar: both countries have 59% of couples with the same

Table 2.1: Women's mean age at life events by education

	Mean age at Finishing education	Couple formation	First Birth	Age difference between spouses	Number of observations	Percent
A. Britain						
Education Equal						
HH	21.9	24.5	29.6	1.7	88	4.5
MM	19.1	22.6	26.3	2.6	222	11.3
LL	15.8	21.3	23.9	2.7	846	43.2
Total					1,156	59.0
Husband higher						
HL	16.2	23.1	26.9	2.5	73	3.7
HM	20.1	24.2	28.3	1.8	98	5.0
ML	16.2	21.9	25.1	2.2	391	19.9
Total					562	28.7
Wife Higher						
MH	22.0	23.2	27.5	1.9	40	2.0
LH	21.2	24.3	27.7	1.3	15	0.8
LM	18.1	22.1	24.8	2.4	187	9.5
Total					242	12.3
Overall Britain	17.1	22.1	25.2	2.4	1,960	
B. Sweden						
Education Equal						
HH	23.5	25.6	27.8	1.9	103	9.3
MM	20.1	22.9	25.5	2.6	56	5.0
LL	16.6	23.2	23.5	3.0	493	44.3
Total					652	58.6
Husband Higher						
HL	17.7	24.6	24.8	2.3	103	9.3
HM	20.6	22.6	24.9	2.6	49	4.4
ML	17.5	23.4	23.8	2.0	160	14.4
Total					312	28.1
Wife Higher						
MH	21.9	25.9	27.2	0.9	36	3.2
LH	21.9	25.0	25.7	3.6	35	3.1
LM	19.9	22.7	23.8	3.0	77	6.9
Total					148	13.3
Overall Sweden	18.4	23.6	24.4	2.6	1112	
Overall both countries	17.6	22.6	24.9	2.5	3,072	

Note: 1. H= education level high, M= medium, L= low; HH= education levels of both husband and wife are high.

2. Other educational sorting defined analogously for husband-wife educational combinations.

Source: Own computations based on the BHPS 1991-1998 and HUS 1984-1998.

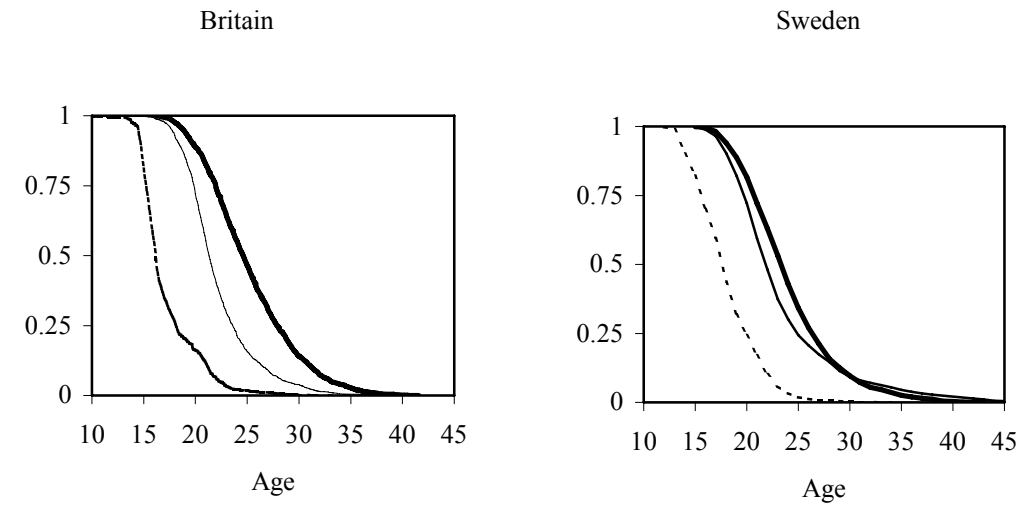
levels of education, followed by a higher level of husband's education (29 % for Britain and 28% for Sweden), and lastly a higher level of wife's education (12% for Britain and

13% for Sweden). Among couples with the same educational levels, couples in which both have low levels take the biggest share in both countries.

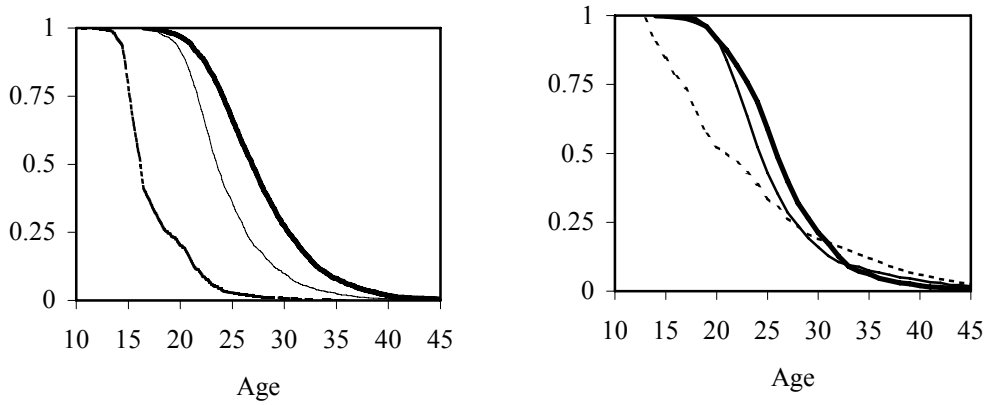
Figure 2.1 shows the Kaplan-Meier estimates for the three life events: age at finishing education, at union, and at first birth for each country by gender. In our data, all individuals finish education, form a union and have a child, so the survival function for not

Figure 2.1: Britain and Sweden: men and women in couples, Kaplan-Meier estimates survival functions

A.Women



B. Men



---- Finishing education — Union ▬ First birth

Source: Own computations based on the BHPS 1991-1998 and HUS 1984-1998.

yet having these events goes to zero. Parenthood occurs later among men than women and translates in such a way that at age 25 about 60-70 per cent of the men are not yet fathers as compared to close to 30-50 per cent of the women. Also we notice marked cross-national differences in the gap between age at finishing education and union formation, the gap in the incidence being wider among British men. The duration between union and first birth is shorter for Swedish couples, about 2 years on average, whereas it is about 3 years on average for British couples. Some Swedish husbands finish their education after couple formation and having their first child. The curve for finishing education crosses the other two curves for Swedish husbands at about age 30.

Table 2.2 presents the distribution by cohorts of couples in the marriage market. The pattern of marital sorting changes over cohorts. Assortative mating is predominant for all cohorts but the proportion of both men and women with medium or higher education increases for younger cohorts. The number of men who marry women with lower education than themselves is at maximum for men born in the 1950s for Britain and for the cohorts born in the 1940s in Sweden. The age difference between spouses is slightly higher among Swedish couples, with men being older than women. The age differential rises from a little more than a year in the oldest cohort to more than 3 years among cohorts born in the 1960s. This increasing age differential between husband and wife is rather counterintuitive because one would think that spouses would become more similar to each other over time as women's life chances increase and men can share their breadwinning obligations with their wives.

2.4 Empirical strategy

The decision about whom and when to marry is a simultaneous decision. Different chapters in Blossfeld and Timm (2003) struggle with the simultaneity of these decisions. De Graaf, Smeenk, Ultee and Timm (2003) use a first stage duration analysis and a second stage multinomial logit on who marries whom. We use a two step method inspired by Ghysels (2003) who built his model based on Blundell and Smith (1994)[3].

The first step consists of estimating a mating function for the choice of the spouse, using a multinomial logit model. The purpose is to sort males and females into couples by predicting the level of education of the husband given the level of education of the woman, her individual socio-economic characteristics, and marriage market variables.

The multinomial logit model provides a set of probabilities for the j choices (marrying a high, medium, or low education person) for a decision-maker with characteristic X_i (Greene 2003, p.721).

[3] However both Ghysels (2003) and Blundell and Smith (1994), on whose work Ghysels built, estimate a linear model in their first step. The estimated values of the endogenous variable as well as the corresponding residuals serve as explanatory variables to the second step of the estimation process. Since our first step is multinomial logit estimated by maximum likelihood, we do not have any residuals to introduce in the second step of our estimation.

Table 2.2: The change in marital sorting by cohort

	A. Britain						B. Sweden					
	Born in						Born in					
	1930s	1940s	1950s	1960s	1970s	All cohorts	1930s	1940s	1950s	1960s	1970s	All cohorts
Education equal												
HH	1	25	29	33	0	88	8	47	36	12	0	103
MM	21	55	64	77	5	222	3	17	26	10	0	56
LL	148	247	203	221	27	846	107	189	121	69	7	493
Percent	66.1	61.6	53.6	57.8			65.6	60.5	53.8	56.5		
Husband higher												
HL	8	20	24	20	1	73	22	49	24	7	1	103
HM	10	18	33	35	2	98	4	15	20	9	1	49
ML	42	109	133	101	6	391	22	61	53	22	2	160
Percent	23.3	27.7	34.4	27.2			26.7	29.9	25.5	23.6		
Wife higher												
MH	1	10	20	8	1	40	3	14	12	7	0	36
LH	1	3	7	4	0	15	3	8	18	6	0	35
LM	25	44	39	74	5	187	8	18	30	19	2	77
Percent	10.5	10.7	12	15			7.8	9.6	17.6	19.9		
Total observations	257	531	552	573	47	1960	180	418	340	161	13	1112
Mean age difference	1.4	2.2	2.4	3.1	3.2	2.4	1.3	2.5	2.8	3.6	5.5	2.6

Note: The percentage educational column distribution for persons born in the 1970s is not shown because of too few observations

Source: Own computations based on the BHPS 1991-1998 and HUS 1984-1998.

$$Prob(Y_i = j) = \frac{e^{\beta_j' X_i}}{\sum_k^j e^{\beta_k' X_i}}, \quad for\ j = High, Medium, Low \tag{2.1}$$

This expression can be normalized by setting $\beta_1=0$ and rewriting it as:

$$Prob(Y_i = j \mid X_i) = \frac{e^{\beta_j' X_i}}{1+\sum_k^j e^{\beta_k' X_i}}, \quad for\ j = High, Medium \tag{2.2}$$

For positive fitted β values the probability of marrying a man of high or medium education (relative to a man of low education) increases and for negative fitted β values the probability of a certain match decreases. The estimates of the multinominal logit result in three predicted probabilities for each woman: her probabilities of marrying a man with high, medium or low education. Since we need to have one and only one predicted education level for each woman's husband, we use that prediction which has the highest probability.

The second stage of our empirical analysis consists of estimating separately hazard-rate models of the durations from age 13 to union formation and from union formation to first birth. We use parametric duration Weibull models and, together with other variables, we use the predicted educational combinations from step one as explanatory variables[4]. The rate of entry into a union or first birth is defined as:

$$h(t) = \lim_{\Delta \to 0} \frac{\text{Prob}(t \le T \le t+\Delta \mid T \ge t)}{\Delta} = \lim_{\Delta \to 0} \frac{F(t+\Delta)-F(t)}{\Delta S(t)} = \frac{f(t)}{S(t)} \tag{2.3}$$

where T is a random variable and t is a realization of T. T has a continuous probability distribution f(t). The cumulative probability distribution is F(t) (Greene 2003, p.792). The hazard rate h(t) without any covariates can be estimated by the Kaplan-Meier product limit estimator, as shown in Figure 2.1 above the survival function S(t) for the three life events.

A parametric duration model, different from the nonparametric Cox proportional model, assumes a particular functional form for f(t) and S(t) and therefore for the hazard function h(t). The probability of someone forming a union or having a first birth, given that it has not happened yet, is likely to increase sharply with age since we start at age 13. We therefore adopt a Weibull distribution, which allows for such a shape. The hazard function for the Weibull model takes the form:

[4] The reason we choose a parametric duration model rather than a nonparametric Cox proportional hazard model is that STATA provides an opportunity to estimate unobserved heterogeneity for parametric duration analysis but not for the Cox method.

$$h(t) = p(\lambda t^{p-1})e^{-(\lambda t^{p})}, \quad \text{where} \quad \lambda = e^{X\beta} \tag{2.4}$$

and λ and p the duration dependence variable are parameters to be estimated. Since we only use observations of individuals who experienced both events, union formation and first birth, our coefficients are interpreted as durations and are not contaminated by the probability of experiencing the event.

Individual differences in the hazard functions are characterized partly by the observed explanatory variables x_i and in part by the unobserved characteristics of the individual. In addition to the observed heterogeneity captured by our included variables the relationship between decisions regarding timing of union formation and first birth may also be affected by unobserved heterogeneity. Heckman and Walker (1990) distinguish between two different types of unobservables: those known to the interviewed person in the survey and unknown to the analyst, and those unknown to both. If unobservable characteristics are correlated with the observables, then not including an estimate of the unobservables will lead to incorrect inference regarding the impact of observables on the timing of events and to problems of identification.

There are a number of ways of extending duration models to account for heterogeneity. A direct approach is to model heterogeneity in the parametric model by defining the survival function conditioned on the individual specific effects, adding to this model a term for the unobserved heterogeneity. This is the same principle as incorporating a disturbance term in a regression model. We use a Gamma distribution for the unobserved heterogeneity. Thus the model can be rewritten as:

$$h(t) = p(\lambda t^{p-1})[S(t)]^{\theta} \tag{2.5}$$

where θ is a parameter for unobserved heterogeneity, with $\theta = 0$ being the case of no unobserved heterogeneity.

Although we may have solved some of the econometric mistakes by our choice of a two step model and the use of the parametric Weibull model that controls for unobserved heterogeneity, we have probably at least two sources of possible bias. First, the way that we selected our sample may introduce a selection bias. (We had used a selected sample so that we could get spouse information, see also Francesconi, 2002, and Naz, Nilsen and Vagstad, 2004). In our case, the larger the differences in age at union formation and age at maternity for cases included in our study, and those not included, the larger is the potential selection bias. In the appendix to this chapter, we show how age at first birth behaves when using all women rather than only women for whom we know the husband's characteristics. Table A2.1 shows that for women in couples it hardly makes a difference whether we know the husband's education and time at couple formation or not. For all women, including those who are single when giving birth, there is a difference. Age at maternity is lower for women who are single when having their first birth. The difference is very small for Sweden but larger for Britain, where teenage pregnancies are more common.

Another reason for biased estimates is that if we do not account for all variables likely to influence the decisions, there may be an omitted variable bias. Using a sample consisting only of women in couples allows using information about the husband, which if not used in the estimations may have resulted in an omitted variables bias. The result is that one must choose which bias is more acceptable.

2.5 The mating function

The results of the multinomial logits for women's choice of the education level of their husbands are given in Table 2.3 for Britain and Table 2.4 for Sweden. The education level of the woman, her social background, and marriage market conditions are used as explanatory variables to predict the education level of her husband. We include the woman's education level-high or medium-with low education as the comparison group.

The number of years spent in fulltime education is entered as an additional variable. The latter variable is correlated with the level of education because it takes more years to achieve a high level of education than a low level, but the correlation is not perfect since there is a variation of the number of years in school within an educational level. Table 2.3 shows that relative to women of low education British women of medium education are 22 times more likely to marry a highly educated man (relative to a man of low education). The relative risk ratios in Tables 2.3 and 2.4 show double comparisons. Also, if given the educational level she spent more years in school, her chances of marrying a high or medium educated man, other things equal, increase, because there are statistically significant and positive relative risk ratios for duration in school in Table 2.3.

We control for woman's birth cohort because, as shown in Table 2.2 above, the educational level of both men and women has increased over time. To identify the social background of the women we use three variables: a dummy variable for 'mother worked' when the respondent was 14 for Britain and 16 for Sweden, measures of parents' social class, and a dummy for foreign origin. For Britain we also include a dummy variable for native and non-White[5]. To measure social class in Britain, we used the parent's job grading of the Goldthorpe-Hope (GH) Scale obtained directly from waves 1 and 8 of the BHPS. This measure is based on rank values that vary from 1 to 124 and a scale value that goes from 17.52 to 82.05. The value of the scale is based on information about detailed occupation classification together with detailed breakdown of the prestige of an occupation. If the GH scale is available for both parents we take the mean value, but if it is only available for one of the parents we use it as it is. We construct three groups by

[5] The ethnicity variable in the BHPS is directly taken from the data set. The question is posed in such a way that the respondent self-classify himself or herself into the different ethnic grouping given (white, Black-Caribbean, Black-African, Black-other, Indian, Pakistani, Bangladeshi and Chinese). We aggregated this variable to distinguish only whether the person is of white race or not. In the Swedish case, the closest question to the ethnicity variable is a question asked about the citizenship of the parents of the respondent. We assigned the respondent to be of Swedish descent if both parents are Swedish citizens, and if either of the parents is a foreign citizen we assigned the respondent to be of foreign origin.

Table 2.3: Britain: Multinomial logit models of choice of spouse for women

	High		Medium	
	RRR	z-value	RRR	z-value
High education [a)]	14.04	1.21	0.27	-0.60
Medium education	22.70	2.19	2.57	1.05
Duration in school *	1.20	5.22	1.14	4.56
Born in 1930s [b)]	0.76	-0.88	0.82	-1.04
Born in 1940s	0.91	-0.40	1.13	0.84
Born in 1950s	1.29	1.11	1.55	2.84
Born in 1970s	0.74	-0.46	0.76	-0.75
High social class [c)]	2.13	4.20	1.37	2.54
Missing social class	0.66	-0.93	0.84	-0.71
Foreign descent or non white [d)]	0.71	-1.09	1.13	0.68
Missing race	0.95	-0.18	0.80	-1.28
Mother worked at age 14 [e)]	1.37	1.77	1.23	1.84
Mother work information missing	3.89	2.86	1.18	0.49
Marriage opportunities for high educated **	1.32	0.32	1.21	0.21
Marriage opportunities for medium educated* *	1.72	0.48	0.87	-0.11
Marriage opportunities for low educated **	5.90	1.44	8.48	1.60
Medium educ. by marriage oppor. for high educated	0.53	-0.69	0.90	-0.10
Low educ. by marriage oppor. for high educated	1.49	0.44	1.09	0.09
Medium educ. by marriage oppor. for medium educated	1.18	0.14	1.25	0.18
Low educ. by marriage oppor. for medium educated	0.88	-0.11	1.45	0.30
Medium educ. by marriage oppor. for low educated	0.27	-0.98	0.15	-1.35
Low educ. by marriage oppor. for low educated	0.68	-0.29	0.17	-1.33
Number of observations				1,960
Log Likelihood				-1646.49
LR Chi square (44)				503.07
Likelihood ratio index				13.25%
Percentage of overall correct predictions				60.1%
Observed frequency		259		653
Predicted frequency		152		378
Average predicted probability		0.13		0.33

Note: 1. Outcome being married to a low educated man is the comparison group;

2. Reference categories for the explanatory variables: a) Low education; b) Born in 1960s; c) Low social class; d) Originally from the country; e) Mother was home at age 14;

3. * Duration in school is duration from age 13 to finishing school;

4. ** (Number of high (or medium or low) educated men in period t: (M_t)/ Number of high (or medium or low) educated women in period t+2: (F_t +2));

5. ∇ is a joint significance at 95% of significance level with a likelihood ratio test.

Source: Own computations based on the BHPS 1991-1998.

Table 2.4: Sweden: Multinomial logit models of choice of spouse for women

	High		Medium	
	RRR	z-value	RRR	z-value
High education [a)]	2.65	1.31	1.86	0.77
Medium education	0.75	-0.43	1.41	0.55
Duration in school *	1.31	6.38	1.16	3.77
Born in 1930s [b)]	2.60	2.17	0.86	-0.40
Born in 1940s	3.00	2.42	1.34	0.76
Born in 1950s	1.58	1.52	1.14	0.52
Born in 1970s	0.89	-0.13	0.42	-1.05
High social class [c)]	2.04	3.25	1.43	1.66
Missing social class	0.47	-0.70	1.06	0.09
Foreign descent [d)]	1.25	0.83	1.38	1.36
Missing decent	4.84	0.88		
Mother worked at age 14 [e)]	1.19	0.96	0.89	-0.69
Mother work information missing	0.88	-0.10	0.00	-23.12
Marriage opportunities for high educated **	1.15	0.79	0.90	-0.5
Marriage opportunities for medium educated* *	0.68	-0.58	1.00	0
Marriage opportunities for low educated **	1.21	0.83	1.13	0.51
Medium educ. by marriage oppor. for high educated	1.09	0.41	1.36	1.29
Low educ. by marriage oppor. for high educated	0.83	-0.98	1.19	0.82
Medium educ. by marriage oppor. for medium educated	1.28	0.29	0.66	-0.45
Low educ. by marriage oppor. for medium educated	1.49	0.54	1.05	0.06
Medium educ. by marriage oppor. for low educated	0.98	-0.08	1.04	0.14
Low educ. by marriage oppor. for low educated	0.83	-0.70	0.95	-0.20
Number of observations				1,112
Log Likelihood				-977.98
LR Chi square (44)				279.78
Likelihood ratio index				12.51%
Percentage of overall correct predictions				61.5%
Observed frequency		255		252
Predicted frequency		205		28
Average predicted probability		0.23		0.23

Source: Own computations based on the BHPS 1991-1998.

dividing the scale into parts at the 33rd percentile (low social class), between the 34rd and 66th percentile (medium), and from the 67th percentile and up (high social class). A dummy variable is created if social class is missing. In the Swedish case, the social class variable is constructed by combining the highest level of schooling of the respondent's father with his occupation when the respondent was aged less than 16.

The results in Tables 2.3 and 2.4 show that being from a high social class increases the probability of marrying a highly educated man, other things being equal, in both Britain and Sweden. Foreign descent or race, other things being equal, has no influence on the probability of marrying a man with medium or high education.

We created marriage opportunity indicators as sex ratios per one-year cohort and each education level-high, medium, low-to control for changes in the distribution of educational attainment over time and across cohorts for both sexes. These variables control for the availability of marriage candidates with a given educational level. In constructing this index a man of cohort t is assumed to prefer marriage to a woman of cohort t + 2 who has the same level of education as he. The sex ratios have been computed as:

$$\frac{M_t^s}{F_{t+2}^s} \qquad (2.6)$$

where *s*=high, medium or low and *t*=cohort and *M* is the number of males and *F* the number of females. Thus the marriage opportunity variables are constructed for each level of education and by single years of birth cohort. We also included interactions of women's own education and the marriage market variables. The marriage market variables and those interacted with woman's own education are not significant, except for one: when marriage market opportunities are favorable for low education women in Britain they are more likely to marry a man who has high or medium education.

We used the estimated models in Tables 2.3 and 2.4 to predict the probabilities of being in each of the outcomes of the dependent variable: marrying a spouse of high, medium or low education. For each individual, three predicted probabilities are obtained. Because we need one predicted value for each couple, we chose the highest one of these three probabilities.

The last row of Tables 2.3 and 2.4 respectively compare observed and predicted frequencies of husband's education level. This average predicted probability, which is computed across all women, shows proportions of husbands with high, medium and low education that are very close to what is shown in Table 2.1 above.

Table 2.5 shows the results using the rule that assigns the maximum of the three probabilities of the education of each woman's husband. The results of the predictions are broken down by the nine educational groupings used in the second step of our estimations. It is clear from Table 2.5 that our model over predicts assortative mating (homogamy) substantially: we predict 88% and 83% of homogamous marriages respectively for Britain and Sweden whereas the observed proportion of homogamous marriages was only 59% in both countries, as seen from Table 2.1 above.

The case where both partners have low education is particularly, over predicted. In contrast, the number of case where the husband has higher education than his wife is severely under predicted in both countries. According to Table 2.1, in 28 percent of the couples in both countries the husband is more educated than the wife, but according to Table 2.5 only 3 to 4 percent are predicted to be in this situation.

2.6 Durations to couple formation and first birth

The second step of our analysis are the two Weibull hazard models with individual unobserved heterogeneity and predicted intra-couple education group, based on the mating function estimated in step 1. The results of the two duration estimations are presented in Table 2.6.

Table 2.5: Predicted versus observed educational levels

	Britain			Sweden		
	Actual	Predicted	% predicted	Actual	Predicted	% predicted
Education equal						
HH	88	139	7.1	103	160	14.4
MM	222	327	16.7	56	23	2.1
LL	846	1,260	64.3	493	740	66.6
Total	1,156	1, 726	88.1	652	923	83.0
Husband higher						
HL	73	0	0.0	103	12	1.1
HM	98	13	0.7	49	33	3.0
ML	391	47	2.4	160	4	0.7
Total	562	60	3.1	312	49	4.4
Wife higher						
MH	40	4	0.2	36	1	0.1
LH	15	0	0.0	35	13	1.2
LM	187	170	8.7	77	126	11.3
Total	242	174	8.9	148	140	12.6
Total Number	1,960		100.0	1,112		100.0

Source: Own computations based on the BHPS 1991-1998

The dependent variables are the durations from age 13 to union formation, and the duration between union formation and first birth. Union formation is measured as the time at which the couple moved in together. For the BHPS, the date of union is collected both in the second wave (1992) and the eighth wave (1998). The data are collected by asking the date of first cohabitation, the end of cohabitation, and date(s) of marriage(s)/divorces. We use the date of moving together of that man with whom the woman lived when her first child was born. Also the family compositions are consistently given in the entire panel. In the BHPS, first birth questions are asked both in the second and eighth waves. The questions were put to all respondents aged 16 and over for both males and females. Furthermore, first-born children are given identification numbers that makes it possible to trace both their parents. Therefore, we can check whether the husband is the biological father of the child. In the HUS, the current marital status and time when the current partners moved in together are given in all the waves. In the HUS, the first birth question comes in the first 2 waves and the last 3 waves in the non-response and supplementary

samples[6]. The family composition data allows one to relate biological fathers to their children.

In the duration analysis we work with both fixed and time varying variables. The fixed variables include the nine educational groups of predicted husband's education for a given wife's education, estimated by our first step presented above[7]. Further, we use the same fixed social background variables as in the mating function and birth year splines to control for birth cohort.

We have merged the British and Swedish data in order to be able to compare the duration to couple formation and to first birth between the two countries, *ceteris paribus,* and include a dummy for 'Sweden'. Another fixed variable is the unemployment rate when the woman was 20 years old. Total unemployment rate at age 20 for each one-year birth cohort is obtained from the ILO yearbook of labor statistics and OECD historical statistics for both countries. For example, if a woman was born in 1931, we use the unemployment rate for 1951[8]. Whereas labor market situation, as measured by unemployment rate, may produce longer durations to couple formation and first birth, we did not include this variable in the mating function for we think that it is unlikely to affect the choice of partners. The unemployment rate at age 20 has a strongly significant, but rather small, negative effect on the duration to couple formation of 6 percent, and no significant effect on the duration to first birth. This indicates that people may wait longer before moving in together if labor market conditions are bad, but they do not wait longer before they have their first child.

The rest of the explanatory variables in Table 2.6 are time-varying: they increase for every period that the person is still at risk, i.e. has not yet experienced the event being explained. Note that a period is a year in the duration to couple formation, but months are recomputed to fractions of a year, whereas in the duration from union formation to first birth a period equals one month.

If an estimated coefficient in Table 2.6 is less than one that an event occurs given that it has not yet occurred, a lower probability in comparison to the reference group is the case and a coefficient larger than one means a higher probability. Since everyone in our sample experiences the events of couple formation and first birth the estimated coefficients are also measures of durations. The duration until an event occurs is the inverse of the probability that it occurs. Therefore, a lower probability means a longer duration and a higher probability means a shorter duration.

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[6] The collection of the HUS data started in 1984 with 1500 households. The panel was interviewed again in 1986 and 1988. A new wave of about 1000 households with a supplementary sample to increase sample size was collected in 1993. In this data collection those who had not responded in 1986 and 1988 were approached again. The last wave of the HUS panel was collected in 1998.

[7] The coefficients of Table 2.4 do not change much if actual educational groups are used as explanatory variables instead of predicted educational groups.

[8] Alicia Adsera (2003) shows that age-specific unemployment rates have a major impact on fertility rates. She used age-specific unemployment rates from late 1960s onwards, gender-specific and activity specific unemployment rates from 1960-1997, but these are not available for earlier cohorts.

Table 2.6: Duration analysis with Weibull model with individual unobserved heterogeneity and predicted education group

Duration from		Woman's age 13 to union in years		Union to first birth in months**	
		Coefficient	z-value	Coefficient	z-value
Log current age		0.00	-52.8	1.81	2.10
Education equal:	HH [a]	0.70	-1.72	0.56	-2.66
	MM	0.72	-1.89	0.93	-0.39
Husband higher:	HL	0.77	-0.88	0.71	-1.07
	HM	0.73	-1.33	0.60	-2.03
	ML	0.74	-1.95	0.65	-2.63
Wife higher:	MH	0.86	-0.28	0.77	-0.48
	LH	0.52	-1.75	0.82	-0.50
	LM	0.91	-0.53	0.94	-0.35
Being in school		0.14	-10.43	0.84	-2.39
1-2 years after school [b]		0.24	-7.93	0.22	-11.88
3-4 years after school		0.80	-3.69	1.26	3.14
5-6 years after school		0.77	-4.39	0.93	-1.11
7-8 years after school		1.01	0.18	1.00	0.03
9-10 years after school		1.44	4.06	0.95	-0.64
11-12 years after school		1.99	5.7	0.86	-1.51
>12 years after school		5.68	13.81	1.21	1.76
High social class [c]		0.84	-3.72	0.99	-0.22
Missing social class		0.91	-1.05	1.25	2.18
Foreign descent [d]		0.79	-3.85	1.34	4.37
Missing race		1.10	1.34	1.25	3.03
Mother worked at age 14 [e]		0.97	-0.73	1.02	0.43
Mother work information missing		0.82	-1.63	0.87	-1.00
Unemp. rate when the woman was 20		0.94	-5.36	1.01	0.95
Sweden [f]		0.73	-6.48	1.63	8.05
Birth years splines: From 1930 to 1939		1.03	2.42	1.01	0.68
From 1940 to 1949		0.99	-0.71	0.98	-0.86
From 1950 to 1959		1.00	0.24	0.98	-1.34
From 1960 to 1969		1.06	3.35	1.05	2.74
From 1970 to 1979		1.17	3.31	1.10	1.81
Weibull shape parameter		3.45	194.44	0.00	-0.16
Unobserved heterogeneity		-17.66		-2.60	-5.92
Number of observations			3,072		3,072
Time at risk			29,649		10,2435
Log Likelihood			945.50		-4812.58
Likelihood Ratio Chi square statistics with degrees of freedom (39)			5752.75		410.34

Note: Reference categories for the explanatory variables: a) LL; b) Still in school; c) Low social class; d) Originally from the country; e) Mother was home at age 14; f) Britain. Also included in the model are marriage market opportunity variables and their interaction with education.

Source: Own computations based on the BHPS 1991-1998 and HUS 1984-1998.

For the educational groupings the case of both husband and wife having low education (LL) is the reference category. These couples are the ones who move in together earlier than couples of other educational groups, because all the other educational groups have estimated coefficients below 1. Our estimates in Table 2.6 therefore show the expected duration from age 13 to union formation by educational groups. The estimates for the educational groups are not very precise, i.e. the z-values are smaller than 2 for positive effects, or larger than –2 for negative effects. The time varying variable 'being in school' has a strong negative effect both on couple formation and on having the first birth once the union is formed.

The country comparison is quite interesting. It shows that, other things being equal, relative to their British counterparts Swedish couples are older when they move in together. This shows up in a probability less than one i.e. 0.73 in Table 2.6, which is statistically strongly significant. In contrast, once a Swedish couple has been formed, they have their first birth sooner. The duration from couple formation to first birth is shorter or equivalently the probability of having a first birth is higher, 1.63 and strongly significant.

The objective behind the Swedish family policies is to make it easier for women to combine education, work, and family life. This is supported by extended paid and protected parental leaves and an extensive system of subsidized early childhood education and care. Parental leaves including maternity leave amount to 18 months. The first 12 months of leave are paid at 80% of wages up to a certain maximum, while one month for the father and one month for the mother is compensated by 90% of the salary of the parent who is on leave. Another 3 months are paid at a low flat rate and the last 3 months are unpaid. But the most child-friendly aspect of Swedish parental leave policies is the great degree of flexibility. The national social security board keeps the account on-line. Parents can check electronically how many days they have been using and how many days are left. Parents can divide their total parental leave time as they want, ranging from both parents staying at home half the time, to one or the other parent fulltime at home.

They can also choose to be paid only e.g. 75 percent of the entitled payment, in which case they get more days (Gustafsson and Kenjoh 2004). By contrast, British family policies are less generous: every mother is entitled to 18 weeks of maternity leave, and those mothers who worked continuously for at least a year before having the child are entitled to an additional 29 weeks of leave. The first 6 weeks of leave are paid at 90% of wages and another 12 weeks at a low flat rate. After the maternity leave either parent can take a parental leave that is unpaid but job-protected and can last up to 13 weeks.

Table 2.7 shows the predictions made using the models in Table 2.6 [9]. Comparisons of the actual to the predicted durations show that the values fairly well replicate the main features of the data for the durations starting from age 13 but slightly overestimate the durations after the end of education to each of the events. The actual durations are not

[9] Chi-square tests are performed to test whether the observed frequencies differ significantly from the expected frequencies. Frequencies were computed on different intervals of durations. The tests suggest very strong evidence against the null hypotheses.

shown in Table 2.6, but are implicit in Table 2.1 and Figure 2.1. Women form their union about 5 years after the end of education in both countries, but postpone motherhood 3

Table 2.7: Predicted mean durations in years for married women born 1930-1979 in Britain and Sweden

	Predicted mean duration from				
	Women's age 13 to		Union to	Women's end of education to	
	birth	union	birth	union	birth
	(1)	(2)	(3)	(4)	(5)
Equal					
HH	16.1	12.9	3.7	3.3	6.5
MM	14.1	10.5	3.2	3.6	7.2
LL	11.6	9.7	2.5	6.6	8.5
Husband higher					
HL	14.8	13.9	2.2	5.3	6.2
HM	16.1	12.5	3.4	3.1	6.7
ML	14.9	11.0	4.2	4.9	8.8
Wife higher					
MH	15.2	12.3	3.1	4.6	7.5
LH	14.5	13.2	2.8	6.7	8
LM	12.0	9.4	2.8	4.5	7.1
By cohorts					
Born in 1930s	12.9	11.2	2.3	7.8	9.5
Born in 1940s	12.3	11.0	2.4	6.5	7.8
Born in 1950s	13.0	10.1	3.1	4.9	7.8
Born in 1960s	12.2	9.0	3.1	4.2	7.4
Born in 1970s	8.5	6.4	2.1	2.4	4.5
Britain (N=1960)	12.8	9.5	3.1	5.4	8.7
Sweden (N=1112)	12.0	11.5	2.2	6.1	6.6
Overall mean (N=3072)	12.5	10.2	2.8	5.6	7.9

Note: 1. (1)-(3) were predicted directly from the three different models, but (4) and (5) were calculated by taking the predictions in (1) and (2) and subtracting the actual duration from age 13 to end of education;

2. Chi square tests are performed between the observed and expected frequencies using intervals of durations. The tests signal a significant difference between the two but of course the test is very sensitive to the choice of the number of intervals and to whether or not including the extremes.

Source: Own computations based on the BHPS 1991-1998 and HUS 1984-1998.

more years in Britain. Figure 2.1 and the results of Table 2.6 show that birth occurs more quickly in Sweden once the couple has been formed. Interestingly, for women marrying a person with lower education than themselves, the duration to union from age 13 is shorter, though motherhood takes much longer to occur. Lesser educated women wait longer after finishing education than more educated women. The educational system can be seen as a marriage market with students searching among other students for a mate, as pointed out,

among others, by Blossfeld and Timm (2003). However, the duration from union to birth is somewhat longer for women born in the 1950s and 1960s as compared to women born in the 1930s and 1940s, but the difference is less than a year on average. The results of Tables 2.6 and 2.7 show that education of both spouses matters. The longest duration from age 13 to birth is if both spouses have high education, and the shortest if both spouses have low education. However, a highly educated woman who marries a man of low education has her baby earlier than if she marries a highly educated man. In general, it is the case that the higher the education of one of the spouses, given the other spouse's education, the longer the duration to first birth.

Moreover, in Table 2.7 we notice cohort effects in the distribution of the durations. Unions do occur earlier after finishing education for the youngest cohorts. The last two rows of Table 2.7 show the country differences, other things being equal. Swedish women enter union later but have their first birth earlier. Swedish women stay in school longer (Table 2.1), but once they finish school and form a union, they are quicker to start a family. Generous family policies and good childcare facilities may have caused this outcome: pronatalist policies may have reached their goal. Although the Swedish policies have been motivated by equal opportunities for women and men, they are intrinsically pronatalist.

2.7 Conclusions

Both in Sweden and in Britain there is positive assortative mating by education and 59% of the women in each country are married to a man with the same educational level. In our mating functions for the British and Swedish marriage markets respectively, the results of assortative mating by education are more pronounced in Britain than in Sweden, as shown by much larger and statistically significant relative risk ratios. Although we correctly predict the education level of the husband for 60 percent of our couples in both countries, our mating functions over predict the same education level couples and under predict the unequal education level couples.

The education level of both spouses, the duration of schooling, and a high level of unemployment at age 20 reduce the rates of transition into both union formation and first birth, or equivalently increase the duration. In particular, we notice a larger duration until each of the two events if both spouses have high education. The two events happen sooner if both spouses have low education. Yet, a highly educated woman married to a man of low education gives birth earlier than if she was married to a highly educated man, which indicates that education of each spouse matters. After the end of education, women wait more than 5 years to form their union, and wait 2-4 years more to have a child. In our duration analysis performed on merged data for Sweden and Britain we find that other things being equal Swedish couples form their union later than British couples, but once the union is formed they have their first birth sooner. This is in line with the generous family policies in Sweden that make it more affordable to have a child earlier. Also looking at the predictions made from the model the younger cohorts are more likely to form unions earlier but postpone childbearing, which is what one would expect given that contraceptives have become widely acceptable and more reliable.

Given that Sweden was a forerunner in accepting contraceptives and unmarried cohabitation, we expected that the country comparison might indicate earlier couple formation in Sweden. However, we do not find this. Perhaps this is an indication that the greater freedom was used to intensively search a sequence of more than one potential marriage candidate. Since we only analyze the couple that resulted in the first birth of the woman, we have not researched the possibility that a different and childless couple relation preceded the one we focus on.

Appendix

Table A2.1: Selectivity analysis on mean age of the mother at first birth

I.	*Time period in which the first child was born*					
	1950s	1960s	1970s	1980s	1990s	Total
A. Kenjoh 2004, also includes women born before 1930s						
Britain	24.9	23.9	27.2	24.5	25.4	
Number of obser.	590	738	801	931	357	3,417
Sweden	24.8	23.8	24.5	25.7	27.0	
Number of obser.	402	613	620	405	210	2,250
B. Our sample in this chapter: women for whom we know						
a) the education of both husband and wife and b) the date they moved in together						
Britain	22.5	23.5	25.0	25.4	28.2	
Number of obser.	112	412	506	601	329	1,960
Sweden	21.3	23.3	24.7	25.7	27.0	
Number of obser.	70	352	367	235	88	1,112
C. All women who have a child and for whom we know						
a) the education of both husband and wife and b) we do not know the date they moved in together						
Britain	22.5	23.4	25.1	25.4	28.5	
Number of obser.	101	351	441	489	238	2,120
Sweden	21.6	23.4	24.7	25.7	27.2	
Number of obser.	145	402	407	249	94	1,297
D. All women who have at least one child and for whom we know the education level						
Britain	22.1	23.4	24.4	24.4	26.7	
Number of obser.	410	837	1013	1105	687	4,052
Sweden	21.5	23.3	24.5	25.6	27.0	
Number of obser.	240	591	621	408	212	2,072
II.	*Time period in which the woman is born*					
	1930s	1940s	1950s	1960s	1970s	Total
B. Our sample in this chapter: women for whom we know						
a) the education of both husband and b) the date they moved in together						
Britain	25.3	24.9	25.7	25.1	21.4	
Number of obser.	257	531	552	573	47	1,960
Sweden	25.2	24.5	24.6	23.4	20.8	
Number of obser.	180	418	340	161	13	1,112
C. All women who have a child and for whom we know						
a) the education of both husband and wife and b) we do not know the date they moved in together						
Britain	25.3	24.8	25.6	25.0	21.1	
Number of obser.	269	566	580	627	78	2,120
Sweden	24.7	24.5	24.4	23.5	20.8	
Number of obser.	281	460	373	170	13	1,297
D. All women who have at least one child and for whom we know the education level						
Britain	24.9	24.4	24.9	24.3	20.9	
Number of obser.	671	1003	1012	1080	286	4,052
Sweden	24.4	24.3	24.6	24.0	21.4	
Number of obser.	429	687	592	315	49	2,072

Source: Own computations based on the BHPS 1991-1998 and HUS 1984-1998.

Chapter 3

Marriage Markets and Single Motherhood in South Africa

3.1 Introduction

Most women would probably prefer to live with the father of their child whether in married or unmarried cohabitation. However finding a good match depends on the availability of marriageable men, so that one can speak of a marriage market (Becker 1981, 1991). Links between labour market positions, government policies, the marriage market and the cost of children have an influence on union formation and fertility decisions (Gustafsson 2001, Ermisch 2003, Gustafsson and Worku, chapter 2 of this dissertation). Several US studies have focused on the causes of existing racial differences in marriages and family structure using the concepts of the marriage market (Wood 1995, Brien 1997, Lichter et al 1991, Angrist 2002).

Other economic factors advanced in American studies are women's independence created by their own earnings, the incentives created by welfare policies and the feeling of powerlessness created by the legacy of slavery (Frazier 1939, Murray 1984, Elwood and Bane 1985, Moffit 1990, Blau et al 2002, Burgess et al 2002, Fitzgerald 2003).

This chapter models women's decisions in the marriage market as an outcome of marital choice. It is the purpose of this chapter to explain the low marriage rate among

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Based on Gustafsson and Worku, 2006. This chapter has benefited from helpful discussions with Adriaan Kalwij, comments received from participants at the biennial conference of the Economic Society of South Africa (ESSA) 2005 in Durban, seminar participants at the Department of Economics of the University of Aarhus, European Society of Population Economics (ESPE) 2006 participants, KAFEE lunch seminar participants the School of Economics, University of Amsterdam and AIAS lunch seminar participants, University of Amsterdam.

African South African mothers. We assume that women other things equal would prefer a civil marriage to other types of relationship once they have a child. This chapter aims at testing the hypothesis that when the sex ratio declines women are more likely to accept less desirable forms of civil statuses.

The rest of this chapter is organized as follows. Section 3.2 describes the different types of marriages in South Africa and gives empirical evidence on the low rate of marriage as well as on the profile of individuals who enter the marriage market. Section 3.3 discusses the economic theory of marriage in the South African context. Section 3.4 presents the empirical strategy followed in the study and section 3.5 describes the data set used. Section 3.6 examines the results and section 3.7 concludes.

3.2 The demography of South Africa

In South Africa there are four population group[1]: African, Coloured, Indian and White (see also chapter 1 of this dissertation). Different types of marriage habits are practiced depending on the population group of the individuals. Civil marriages are similar to those in developed countries. Traditional marriages, also known as customary marriages, include marriages according to African tradition as well as ceremonies according to the Hindu or Muslim religions. Traditional marriages may be polygamous. In 2001, there were 31,382 polygamous men in South Africa. Before 1984 all marriages among Whites and Coloureds were civil marriages by which men and women shared their joint marital property equally unless they specifically chose not to and signed an ante nuptial contract. Africans and Indians could choose to marry according to civil or customary marriages. In customary marriages, women had no right to the marital property if they were divorced or widowed.

Panel A of Table 3.1 shows the marital status of the White and African South African female population aged 20-40, overall and according to motherhood and education, according to the 2001 census. The breakdown for all females in both 2001 and 1996 is also given for comparison. It can be seen that among women aged between 20 and 40 with at least one child, 78% of the White women were in a civil marriage while only 19 % of the African women were in a civil marriage and 16% were in a customary marriage. If unmarried cohabitation is added, a total of 47% of women live in a union with a man presumably in most cases with the father of their child. But more than 48% of the African mothers had never been married and probably lived as single mothers with their children.

Panel B of Table 3.1 shows the population sex ratios, namely the number of men divided by the number of women, for South African Africans and Whites separately, for all ages and for persons aged 20-40, in 2001. We include similarly computed sex ratios for

[1] This study only looks at African and White South Africans, for comparability with the US studies, and ignores Indian and Coloured (mixed race). The apartheid terminology is still used for monitoring reasons although people are self-classified as to population group. See footnote 5 for more details of the situation under apartheid.

Table 3.1: Demographic characteristics of South Africa

A. Marital status	African				White			
	Never married	Married civil	Married customary	Living together	Never married	Married civil	Married customary	Living together
Census 1996: All women	67.5	12.0	10.4	3.4	37.4	46.0	0.8	1.9
Census 2001: All women	66.6	10.9	8.7	5.6	35.6	45.1	0.9	3.4
Census 2001: Women 20-40								
With at least one child [a)]	48.4	18.5	15.7	12.9	5.2	78.0	1.6	5.8
Highest education:								
None	46.0	12.6	21.3	14.9	43.8	40.0	2.6	5.6
Low	50.8	14.5	15.4	15.1	19.1	61.2	1.8	8.2
Medium	66.7	14.0	8.3	8.9	27.3	57.1	1.2	7.3
High	57.0	28.1	6.4	5.0	26.9	60.0	1.0	6.6
Employed	51.4	20.9	9.8	12.2	25.6	57.2	1.1	8.0

B. Sex ratios 2001	Britain	Sweden	SA: African	SA: White	SA: Total
Men total (Thou)	25,574	4,869	16,887	2,080	21,434
Women total (Thou)	26,786	5,374	18,528	2,212	23,385
Sex ratio total	95.5	90.6	91.1	94.0	91.7
Men 20-40 (Thou)	7,772	1,319	5,755	665	7,292
Women 20-40 (Thou)	7,829	1,295	6,271	691	7,894
Sex ratio 20-40	99.3	101.8	91.8	96.4	92.4

C. Mortality in South Africa among those 15-49, 1997-2001	Men 2001	Women 2001	Sex ratio 1997	Sex ratio 1999	Sex ratio 2001
1. Tuberculosis	20,325	17,473	147	133	116
2. Influenza and pneumonia	8,405	10,170	109	93	83
3. Certain disorders involving the immune mechanism	3,835	5,090	68	75	75
4. Intestinal infectious diseases	3,535	4,991	83	77	71
5. HIV	3,542	4,009	96	94	88
6. Other forms of heart disease	2,809	2,852	111	103	98
7. Cerebrovascular diseases	1,882	1,942	111	110	97
8. Chronic lower respiratory diseases	1,656	1,423	134	129	116
9. Other viral diseases	1,519	2,160	-	-	70
10. Inflammatory diseases of the central nervous system	1,485	1,473	-	-	101
Other causes	59,533	39,156	210	177	152
… of which unnatural	29,061	6,858	410	389	424
All causes	108,536	90,733	169	140	120

Note: a) Proportions in other categories were low and not germane to our study. Among African women aged 20-40 with at least one child, 2.0% were widows; 1.3% were separated and 1.2% were divorced. Among Whites 1.2% were widows; 0.9% were separated and 7.2% were divorced.

Sources: Own computation based on South African Censuses 1996, 2001; Office of the National Statistics UK: Mid-2001 population estimates for England and Wales; Statistics Sweden: Administrative records data, 2001; Statistics South Africa: Mortality and causes of death in South Africa 1997-2003.

Sweden and Britain for comparison[2]. The White population of South Africa has sex ratios closer to those countries.

Women are in the majority for all the populations presented in panel B, with a total sex ratio of 90.6 for Sweden and 95.5 for Britain. In Sweden, this is largely due to an over-representation of older women because women's life expectancy is higher than that of men. The picture is different if we focus on people in the age group 20-40, defined as the age group of interest for our purpose since marriage and childbearing for the most part takes place in this age group. The sex ratio is close to 100 for the age group 20-40 in Britain (99.3) and in Sweden (100.2), whereas it is lower among White South Africans (96.4) and as low as 91.8 among African South Africans. Table 3.1 shows that there are 1.6 million fewer African men than women in South Africa and half a million fewer African men than women in the age group 20-40.

In panel C of Table 3.1 we examine mortality data for South Africa, which is available for the age group 15-49[3]. The data show a clearly higher mortality among men than among women for these young adults. The number one killer disease is tuberculosis. Men in this age group are also four times more likely to die of unnatural causes than women, mostly as a result of violence. The rate is probably higher than stated here since we are dealing with reported causes of death only.

In 1997, the sex ratio from all causes of death was 169, meaning that 1.7 times more men than women died when aged 15-49; and had decreased to 120 by 2001. The under-representation of men aged 20-40 from the census 2001 data reported in panel A of Table 3.1 is likely to be the result of higher male than female mortality during the previous two decades. It is possible that the mortality sex ratios are even higher among Africans. The mortality data cannot be broken down by population group but Africans make up the vast majority of the total South African population (79% in 2001) and heavily weight the total. This shortage of men in marriageable age groups may be one reason why there are such low marriage rates among African mothers.

3.3 Marriage in South Africa

Under apartheid law[4], the various customary marriages were not recognized as legal marriages and thus not regulated by the government. Although marriage laws were different for Whites and non-Whites, as noted above, husbands received marital powers over their wives in all types of marriage[5]. Women were regarded as minors and could not

[2] For Britain, mid-year of the resident population estimates revised in the light of the local authority population studies are used. For Sweden administrative record data showing the conditions in December 2001 are used. To make the comparison easier, 2001 data has been used for all the countries.

[3] Death registrations are based upon voluntary registration and thus can be registered years after the event. Official mortality data derived from this source can thus be incomplete, although deaths are captured according to year of death not year of reporting. The data is available for 15-49, which differs from our age group of analysis of 20-40.

[4] After the Afrikaner Nationalist party came to power in 1948, apartheid was systematized under a series of laws, with the main ones being the Population Registration Act of 1950, which put all South Africans into 4 racial categories: Bantu (black African), Coloured (of mixed race), Indian and White; the Group Areas Act

own property in their own right, enter into contracts without the help of their male guardian, or act as guardians of their own children. This may be one reason why during the apartheid years, African women preferred having no marriage and tried to provide as single mothers for themselves and their children.

For some South African traditionalists, polygamy is a way of preserving their culture. Polygamy was in the past mostly confined to members of the royal family and traditional leaders. It also solved the problem of the barren wife that the husband cannot abandon, since divorce was not allowed in African customary marriages. According to customary laws, the first wife has to give consent to the second marriage. The husband must also provide proper living arrangements whereby the wives get their separate quarters. However because of the system of migrant workers and thereby lack of control from the community these rules were often not observed and men married a second wife without the knowledge of the first wife. Subsequently, the first wife often found herself deprived from access to the marital property. To many people traditional marriage without polygamy is a cultural manifestation. According to census 2001 as many as 15.7 % of African women aged 20-40 are in traditional marriage as noted above in Table 3.1.

Lobola (or bride price), the transfers of cattle and/or money by the husband to the wife's father, validates customary marriages. It is as if the husband buys his wife from her parents. Becker (1991) p. 86-87 comments: "Bride prices then not only compensate parents for their transfer of their 'property' but also induce them to invest optimally in daughters if girls with appropriate accumulations of human capital command sufficiently high prices". In Asia it is common for the bride's family to pay a dowry to the groom's family (e.g. Parish and Willis, 1995). It is as if the groom's family takes over the responsibility of providing for her, thinking about what she will cost rather than thinking about what she will produce as in the African case. The settlement of the terms of the lobola is done through elaborate negotiations between the two families. As soon as the lobola price is agreed upon the first installment is delivered and the rest is paid later[6]. Although some feminists view lobola as oppressive to women, people are still attached to the customs of lobola and children are considered illegitimate if lobola has not been

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of 1950 and Land Acts of 1954 and 1955 assigned races to different residential and business sections in urban and rural areas; the 1952 pass law enacted to control influx of the African population into urban areas required African men and women over the age of 16 to carry a pass book showing permission to stay in urban areas. The law allowed the arrest and removal of any African who is considered idle and undesirable. By leaving the workers families on the land with the assumption that women could feed their families of the produce of the land it was possible to pay lower wages and avoid having to build houses and supply services that were essential to maintain urban populations while ensuring the continued supply of labour through annual leave periods that allowed the birth of children. The Pass Laws were repealed in 1986 and that eased legal restrictions on the migration from rural areas to the cities and townships by people searching for work. But the migration also caused a proliferation of informal settlements (squatter communities) on the periphery of urban centers.

[5] The matrimonial Act of 1984 scrapped marital power of a husband over his wife in White civil marriages. The Marriage and Matrimonial Property Amendment Act o f 1988 made African civil marriages automatically joint property for husband and wife and scrapped marital power of the husband.

[6] In 2005, lobola payment can vary from R10,000 to R25,000 depending on the value of the bride. In 2005 the exchange rate was on the average €1 to R12.66.

transferred. Thus while lobola payments are not necessary in civil marriages many Africans who marry in civil marriages go through the rites of lobola transactions[7].

In 1998, the Recognition of Customary Marriage Act was passed giving legal recognition to African customary marriages through compulsory registration of the marriages and abolishing the husband's marital powers. Marital property is automatically the joint property of the husband and wife unless an ante-nuptial contract is signed between the partners. The law directs that entry into customary marriage must be with consent of both partners. This means that widows do not have to marry their brothers-in-law as traditionally, but can do so if they agree. Even polygamy is permitted to continue as long as the interests of the first wife are protected. The law regulates second and subsequent marriages entered into by the man by cutting down on the excessive power that a husband used to have in a customary marriage. Furthermore, the law ensures equitable distribution of family property between all wives and children and thus is seen by many as solving the problem of property rights on the death of the husband[8] (Mamashela and Xaba, 2003). In addition, the law regulates the dissolution of customary marriages and thus ensures the protection of women. However some argue that the true reason why polygamy couldn't be outlawed was that individual choice between customary and civil marriage should be considered a matter of democracy and freedom of choice in the new South Africa. Others view this choice as a pure matter of personal taste and thus it should be replaced by civil marriage.

Traditional African marriages affect people's lives in South Africa in the early 21st century. The most famous polygamist is the ex-deputy president Jacob Zuma who was married to 3 wives and paid lobola for a 4th wife in 2002. One of his wives, the Minister of Foreign Affairs Nkosazana Dlamini-Zuma, divorced him in 1998, another wife died of a heart attack in 2000, and he is still married to the 3rd wife. His 4th wife to be is Princess Sebentile Dlamini, a niece of Swazi King Mswati III. Mr Zuma has paid a down payment of 10 cattle to the family of the bride and could pay from 50 up to 100 head of cattle as speculated by some newspapers to marry a princess[9]. Although there has been no official statement from the royal family, there has been much speculation that the wedding is off due to the tarnished name of the ex-deputy president[10]. Another example of polygamy is that of the Chief Executive Officer of Johannesburg City Power, Mr Mogwailane Mohlala, who announced in an interview with a Sunday paper in 2003 that he was looking for wife number two. Apparently his first wife, who was sitting next to him during the interview, was quite comfortable with this idea as long as she was part of the decision-making process[11].

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[7] Even with the recognition of customary marriages as of 1998 couples tend to register their marriages as civil but would still practice the rites of lobola transfers. Lawmakers tend to currently look at the best interest of the mother and child when lobola-related custody or money transfers become court cases.

[8] The court has to approve a written contract that will regulate the matrimonial property. The court may not grant the application for the second and subsequent wife if it believes that the interests of all parties are not sufficiently safeguarded.

[9] Gama L., 2002, Zuma to marry Swazi princess, City press.

[10] Schmidt M., Carter C. and Terreblanche C., 2005, More woes for Jacob Zuma, Saturday Star.

[11] Ndlangisa S., 2003, Wanted: wife No. 2, The Sunday Times.

Another example is a young woman widowed at age 32 who was married by customary law to her late husband. The couple bought the property after their marriage while during the marriage the wife invested most of her own income in the improvement of the property. In 2003 when her husband died, her in-laws occupied her property, making reference to their rights according to traditional marriage. Before 1998, in customary African marriages no actual wedding ceremony and signing of a marriage contract needed to take place. Lobola payment was the proof that the marriage had taken place, therefore the young widow didn't have a marriage certificate. Thus according to the old law, she had no right to the property of her husband and succession to the property goes through the male lineage of the family (her eldest son or her husband's male relative). The marriage did not produce any child but her husband had a daughter from a previous relationship. The brother-in-law claimed guardianship of both child and widow and occupied the house together with his family. The young widow returned to her parent's house and battled in court to get back what belonged to her. According to the 1998 Recognition of Customary Marriage Act she must win her case and this has in fact occurred.

Cohabitation in South Africa has no legal bearing in terms of ownership of assets unless the property is registered under both partners' names. Partners have no automatic right to pensions and other benefits. Either of the parents can act as legal guardians of the children depending on the best interest of the child. This was the situation of an African woman who works as a domestic worker. She was in unmarried cohabitation for more than 10 years with a man that she called her 'husband'. He was still legally married to another woman with whom he has four children. This man has five children with the domestic worker and has guardianship of all nine children. Upon recent break up of the relationship, the domestic worker is fighting to get guardianship of her five children so that she can get access to child support grants from the government for her children.

These examples show how African women depend on men. There are contradictions between the legal situation, which demands that men provide for their families, and the reality which is that men can get away from the dependence requirement if they are not married to the mother of their child. This makes them less interested in controlling their fertility. The possibility for women to enter paid work and access different forms of government support has recently made an important impact on relationships making women more independent from men and also pushing away from marriage.

3.4 Theoretical considerations

3.4.1 Gary Becker's theory

Following Becker (1991), we analyze marriage markets outcomes for women or men in terms of gains from marriage output. The marital output includes labour earnings but also results of household work and enjoyment of children. Let us assume identical male and female marriage participants and let a common marriage output be produced within the household and be known with certainty.

Let the partners' marriage output be:

$$Z_{mf} = Z^m + Z^f \qquad (3.1)$$

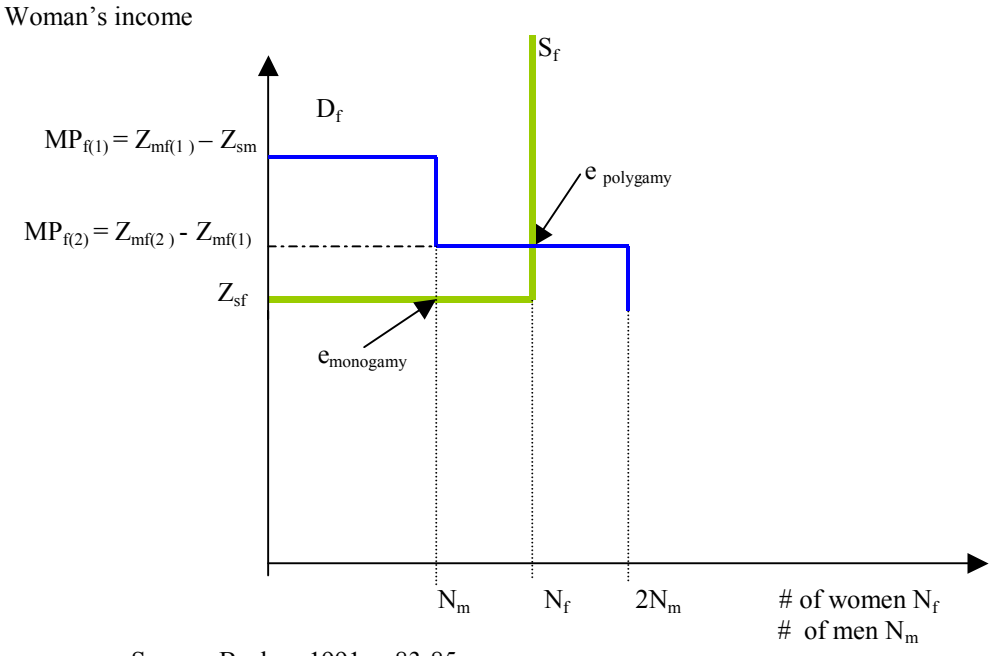
where Z^m and Z^f are male and female shares of marital output within marriage respectively. Men and women would prefer to marry if and only if their utility from marriage exceeds their utility from remaining single:

$$Z^f > Z_{sf} \quad and \quad Z^m > Z_{sm} \qquad (3.2)$$

where Z_{sf} and Z_{sm} are outputs of single women and men outputs respectively. At $Z^f = Z_{sf}$ women are indifferent between marrying and being single, at $Z^m = Z_{sm}$ men are indifferent between marrying and being single, and at $Z_{mf} - Z^m < Z_{mf} - Z_{sm}$ men gain from marrying.

Because as shown in Table 3.1 above, the sex ratio is below 1 in South Africa, we will carry out the argument for a situation where the number of women exceeds the number of men. In the case of monogamy, if $N_m < N_f$ as drawn in Figure 3.1 all men marry and some women ($N_f - N_m$) remain single. In this case all men take all gains from the marriage. These women are willing to stay single because their income equals the income of married women. If $N_m > N_f$ then women take all gains from marriage. Thus the model suggests that the proportion of married women is positively related to the ratio of men to women.

Figure 3.1: Equilibrium male-female income distribution in monogamous and polygamous marriages



Source: Becker, 1991 p. 83-85

The above discussion can be extended to polygamous marriages. Assume that the demand for wives increases with polygamy, thus some men are willing to marry an additional wife and offer her:

$$Z^{f} = MP_{f(2)} = Z_{mf(2)} - Z_{mf(1)} \qquad (3.3)$$

Where the marginal product of a second wife $MP_{f(2)}$ is computed according to formula (3.3) and $Z_{mf(1)}$ is the output of a household with one man and one woman and $Z_{mf(2)}$ is the output of a household with one man and two women. Equilibrium in an efficient polygamous marriage market does not require that the same number of men and women want to marry, only that the number of women who want to marry equals the demand for wives. Thus at point $e_{polygamy}$ all men and all women marry and some men have two wives.

At $e_{polygamy}$ all men and all women receive the same income $Z_{mf(2)}$ - $Z_{mf(1)}$ where all receive the same marginal product of the second wife. Although the number of women is higher than the number of men, the equilibrium income of women is above their single income. Thus women would rather enter polygamous marriages than remain single. In sum, if all men had at least one wife and some had two wives, monogamy would cost each woman the difference between the marginal product of the second wife and her single income. Thus according to Becker (1991), in the situation where there are more women than men, as is the case among Africans in South Africa, women are better off in terms of income under polygamy than under monogamy. Given the inequality in resources between women and men and the shortage of marriageable men, it is better for a woman to be a second wife than remain single. It is even the case that all women benefit if some are second wives because this mechanism washes away the shortage of men. This does not mean that women are happy with these arrangements. If they had more resources they would prefer an egalitarian monogamous marriage. If the women were better off as single women they would not accept marriage. They might be better off as first wives only if they have the opportunity to have a say in the choice of subsequent wives, as in the anecdote of Mrs Mohlala, whose story suggests that she would not consent to a second wife unless she played a role in the process.

3.4.2 The incidence of polygamy, bride prices and dowries

From Figure 3.1 it is clear that sex ratio imbalances are necessary for polygamy to occur. Becker argues in a subsequent section that heterogeneity in men may cause the wealthier men to become polygamists even if some men remain single. Grossbard (1976) used survey data collected in 1969 on the Maiduguni tribe (Nigeria) and showed that polygamy in this tribe was a positive function of male income and male education. She also showed that the more educated the senior wife was, the fewer her co-wives, suggesting that some men had substituted marriage to one highly educated wife for marriage to a number of uneducated women. There is also the probability that an educated wife commands a higher bride price, so that the resources of the man could be spent on one high quality wife rather than on two low quality wives. Kanazawa and Still (1999) used data from 127 countries

and organized them according to an index which runs from 0 if there was only monogamy to 3 if polygamy was widespread. They explained this index by the degree of democracy in 1960, 1965 and 1980 and income in those same years. They found that income inequality was the most important prediction of incidence of polygamy and showed that increasing women's power resulted in more polygamous marriages if the inequality of men's resources was large, but in more monogamous marriages if that inequality was small. Using this hypothesis, Gould et al (2004) argued that the incidence of monogamy or polygamy is determined by the sources of inequality, not just the level of inequality. In particular, they showed that the marriage market is more monogamous if inequality is determined more by differences in human capital than in non-labour income. They estimated the probability of having one or more wives in Cote d'Ivoire. Their finding shows that richer men have more wives. But after controlling for total wealth, they found that men who earn their money through education and labour income have fewer wives.

Becker's (1981, 1991) marriage model also includes transfers required to clear the marriage markets; these are commonly known as bride prices or dowries, but he refers to them as the price of the joint value of marriage over the utility of either spouse had he/she remained single. Bride price or lobola is viewed as a payment made as compensation to the bride's family for the loss of a productive member of the household, but also payment by the groom's family for the services he receives from his wife including the rights to the children she bears for him. But some authors maintain that such transfers are unrelated to the marriage market and should be regarded as bequests given to sons and daughters at marriage or as having some kind of ceremonial or status-defining function (Botticini and Siow 2003, Kressel 1977). In South Africa, lobola transfers occur even if the marriage is a civil modern marriage. The high unemployment rate and the low incomes of the urban poor make it impossible for many of them to raise the lobola money and they are therefore not allowed to marry. The recent shift to cohabitation may be partly because of the lobola price. Unfortunately we do not have data on lobola payments.

3.4.3 Sex ratios and single motherhood in previous studies

Becker's theory predicts that sex ratios have implications for the proportion of women who remain single and this prediction has been analyzed in a number of studies. Bergstrom and Lam (1989) assumed that men preferred to marry a woman who is three years younger. Large fluctuations in the fertility rate therefore resulted in large imbalances on the marriage market. The model was estimated on all men and women born between 1895 and 1945 in Sweden. They observed that reduced sex ratios were associated with a decline of the age gap between the spouses, men having to accept a wife less than three years younger, and a decrease in the proportion of women marrying in comparison to adjacent cohorts.

The incidence of single motherhood among Afro-American women in the United States is much larger than among White American women. The main idea explored in a number of US studies is that being a single mother rather than marrying the father of her child can be partly explained by the shortage of marriageable men (Wilson 1987, Lichter

et al 1992, Wood 1995, Brien 1997, Fitzgerald 2003). An important finding from these studies is that marriage market variables must include a spouse quality measure. The definition of a marriageable man used by Wilson (1987) is that he is employed, and Wilson's finding suggests that the short supply of employed men is the reason for the rise in single motherhood among Afro-American women with a low level of education. Wilson subsequently inspired other researchers to expand on the definition of a marriageable man. These studies have assumed that spouse searching are segregated by race and age and generally confined to some (local) geographical area.

There have been two main types of empirical studies of marriage markets: those using static models and those using dynamic models. Wood (1995) used the 1970 and 1980 US census data aggregated at SMSA[12] level for the different categories (sex, race, employment status, income, marital status) to estimate a fixed-effect model of the proportion of Afro-American women aged 20-34 ever married. He included both married and unmarried men when constructing the sex ratios. This is logical because the model is static, using the proportion of married women as the dependent variable. He used three definitions of marriageable men: 1) all men; 2) men who were employed full-time; and 3) men who earned above a certain threshold (in this analysis he used three different cut-off points). The sex ratios were based on 76 SMSAs which had an Afro-American population of over 30,000 people. He concluded that the decline of the pool of high income marriageable Afro-American men was responsible for 7-10% of the 1970-1980 decline in marriage rates among Afro-American women aged 20-34.

Angrist (2002) studies the effects of sex ratios on the incidence and quality of marriage and notes that about 50% of all marriages are within the same ethnic group. The quota act of immigration in effect from 1921 to 1965 sets annual quotas on the basis of nationality from the mainly European immigration e.g. Italians, Irish etc. had different quotas. Because of the quotas' large-scale exogenous variation in both the number and sex composition of new immigrants, Angrist uses these immigration sex ratios by ethnicity as instruments for marriage markets sex ratios of the various ethnical groups. He finds that higher sex ratios are associated with higher marriage rates for men and women, lower female labour force participation and higher spouse and couple income. His findings suggest that children born to parents in a high sex ratio environment are economically better off.

The second type of studies uses dynamic models of the hazard of entry into first marriage with predetermined time-varying explanatory variables. Lichter et al (1992) study women's transition into first marriage using panel data and defines the marriage market as consisting of: 1) unmarried men; 2) unmarried men who are employed; 3) unmarried men who are full-time employed; and 4) unmarried men whose income is above a certain threshold. They use the National Longitudinal Survey of Youth (NLSY) to analyse Afro-American and White American women aged 18-28. They construct sex ratios using US census 1980 data (PUMS-D data) to allow for 382 local marriage markets.

[12] Standard metropolitan statistical area. The USA was divided into about 318 SMSAs to facilitate the 1970 and 1980 censuses count.

They conclude that a shortage in the quantity and quality of available mates in local areas slow down women's transition to marriage. They also conclude that local mate availability accounts for most of the observed racial difference in marriage rates in the US.

Brien (1997) studies the timing of first marriage using the NLS72 longitudinal data. He uses five definitions of marriageable men: 1) all men; 2) all employed men; 3) all men who are employed, in school or short-term unemployed; 4) all men who are full-time employed; and 5) all men with earnings above a certain amount. He uses the 5% sample of census 1980 data to construct the sex ratios and he distinguishes different level of geography (county, SMSA, state) for all the sex ratios; his pool of marriageable men definition coincides with that of Wood (1995). Brien argues that the 1980 marriage market characteristics can be expected to capture the marriage market characteristics over the entire NLS72 data sample. He uses the US NLS72 longitudinal data to study the role of the marriage market in the timing of first marriage among Afro-Americans and Whites. He concludes that residing in a state that has a favorable marriage market shortens the waiting time to marriage and he attributes racial differences in the timing of marriage to differences in the availability of marriageable mates. In addition, Brien's finding suggests that disaggregating marriage market variables by low geographical level (county in his case) can mask the true impact of these variables due to measurement error in small area definitions.

Burgess et al (2002) measure the marriage market by the average quality of potential partners. They study transitions to first marriage and exits from first marriage using the NLSY 1979-1992 panel data. They propose that a higher own income has two opposing effects on the one hand the 'self-reliance' effect, which can make marriage less likely, and on the other hand the 'good catch' effect which can make marriage more attractive. Furthermore, AFDC aid for families with dependent children which was available for single mothers in the US[13] during the period of study increases women's income.

Fitzgerald (2003) studies the link between spouse availability and the duration of welfare use among US women. He uses household panel data collected among AFDC recipients starting from 1984. The study sample includes single women with children. He measures the marriage market by using plain sex ratios not adjusted for employment or income of unmarried men to unmarried women from the 1980 census. He concludes that the availability of employed single men speeds exit from welfare. He further shows that for Afro-American women labour market conditions are more important than marriage market conditions for exit from welfare.

It has been argued that these women are better off as single mothers because of the low quality in terms of earnings and personal characteristics that the available men can offer,

[13] Aid to Families with Dependent Children (AFDC) is a welfare system in the US created in the Social Security Act of 1935 to provide cash assistance to children who had been deprived of the support of one of their parents, usually the father. Initially, the program paid benefits only to children; adults were not counted in the grant calculation until 1950. AFDC is supposed to have induced some women to enter motherhood thereby achieving financial independence through this support. Also this system is supposed to discourage labour force participation. Many of the US states have substituted the AFDC system by the Earned Income Tax Credit (EITC) which does not have these work disincentive effects.

and would thus rather rely on state welfare income to survive. Another factor to which the single status of women has been attributed and which has been the focus of much research is the economic independence of women through labour income. The literature provides different measurements for women's independence using time-varying values for education, employment status, earnings in the previous year, and public assistance income received during the year preceding the survey date (Lichter et al, 1992, Brien 1997). Wood (1995) constructed a women-earning index to measure women's economic independence. The index was constructed using the national median earnings of Afro-American women, the national concentration of Afro-American women and the employment rate in the SMSA for each industry. Wood also developed a measure for welfare generosity by taking the maximum AFDC benefit available for a family of four as well as the cash value of food stamps and Medicare by SMSA. We conduct a study for South Africa similar to those discussed above drawing mostly from the US studies.

3.4.4 Sex ratios and marriage markets in this study

The 53 district councils[14] (DC) are assumed to be the geographical area where women search for potential partners. We consider the province to be too broad and the local municipality too narrow to measure the local marriage market. We construct the local marriage market variables as follows:

$$SRP_i = \frac{\sum_{i}^{i+9} M_i}{\sum_{i-3}^{i+6} F_i} \qquad (3.4)$$

where SRP_i is the sex ratio for the population of each single year of age i. M_i is the number of all men for a certain population group and in a certain age group in the local marriage market. F_i has a similar definition. For a 20-year-old African woman, the sex ratio is equal to the number of African men aged 20 to 29 divided by the number of African women aged 17 to 26. By selecting this age range for the computation of the available pool of marriageable men, we assume that women have a preference for men of their own age or

[14] Administratively, the country is divided into nine provinces (Western Cape, Eastern Cape, Northern Cape, Free State, KwaZulu-Natal, North West, Gauteng, Mpumalanga, Limpopo). The provinces are in turn divided into 231 local municipalities. Each has a unique name, a unique code number and clearly defined boundaries. These municipalities are grouped into district councils. The 53 district councils define our marriage markets used in this study. Included with the district councils for this purpose are six independent metropolitan areas, which feature a high population density and multiple business districts and industrial areas. They are: City of Cape Town Metropolitan Municipality; Ethekwini Municipality (Durban); City of Johannesburg Metropolitan Municipality; Ekurhuleni Metropolitan Municipality (East Rand); Nelson Mandela Metropolitan Municipality (Port Elizabeth); and City of Tshwane Metropolitan Municipality (Pretoria). Level five in the geographical area hierarchy structure are the 2,674 main places in total. Level sixth in the geographical area hierarchy structure are the 15, 966 sub-places. Statistics South Africa has created 80, 787 enumeration areas (EA) for the census 2001 (Statistics South Africa, 2003).

at a maximum 9 years older. Some women do marry much older men and that is one possible effect of an unfavourable marriage market to women. Next we compute three other ratios by modifying the numerator of the above ratio where M_i becomes: 1) the number of employed men; 2) the number of men with completed education higher than grade 12 (in South Africa referred as standard 10); and 3) the number of men with an income greater than R800 per month. These sex ratios are calculated for the 53 local areas (district councils) and for each of the population groups. Thus we have 53x4=212 local marriage markets. Furthermore, as shown in equation 3.4, an individual woman is given a marriage market value which varies with her age (with 21 possible values), with her population group (4 possible values) and the district council in which she lives (53 possible values). Therefore there are 21x4x53=4,452 different values of the four different marriage market indicators we use.

In South Africa, there is no national poverty line and researchers have used different measures of poverty[15]. We use 800 Rands as the poverty level. Given the small number of interracial marriages that take place in South Africa, it is proper to assume that the marriage markets are racially segregated[16].

In panel A of Table 3.2, the sex ratios averaged over the 53 district councils are shown for selected ages of the woman, for each population group and according to the different definitions. Since they are computed for groups they will be exogenous to individual women, the unit of analysis in our study. The average number of men for each woman among Africans declines from 0.869 at aged 20 to 0.637 at age 40. The decline is similar for Whites. On the other hand, at age 30 for each African woman there are only on average 0.283 men with sufficient income, which is the largest deficit among all population groups in the country, with Indians showing a surplus. White women at age 30 have a better marriage market than an African woman at any age.

In panel B, we present mate availability in the US computed by Lichter et al (1992) who use definitions of marriage markets similar to ours. Mate availability measures by employment status or sufficiency of income show deficits of Afro-American men that are larger than of White men. One of the reasons that the sex ratio declines with age is that men in search for jobs move out of the district council, which defines our marriage markets. This results in men and women living in different marriage markets with very low sex ratios in some areas and rather high in other areas. Our inclusion of several age 10 cohorts in the sex ratio may result in sex ratios considerably diverging from 1 if there are

[15] In 2000, a household income of R800 per month was considered as poor (Stats SA, 2000). The Human Science Research Council considered an income of R587 per household member as a poverty income (HSRC, 2004). Currently R2 000 is considered the minimum wage in the public sector. We use an individual income of R800 per month or above as income suitable to support a family. In October 2001, R11.91 equaled €1.

[16] The 1949 Mixed Marriages Act prohibited marriage between persons of different population groups. The 1950 Immorality Act also banned sexual relations between non-Whites and Whites. The 1950 Group Area Act declared areas for the exclusive use of one particular racial group. It made it compulsory for people to live in an area designated for their classification group. Although this legislation has now been scrapped marriage across racial lines still rarely occurs.

temporal fluctuations in the fertility rate between one year cohorts. Furthermore because Lichter et al study the entry into marriage it is natural to include only unmarried people in the sex ratio. Since we study the proportion of women in four different marital statuses in a given year 2001 it is natural to include people of all marital statuses in the sex ratio computations.

Table 3.2: Sex ratio of availability of mate by population group and age

A. Mate availability in South Africa 2001

	African				White			
Age	Sex ratio	Employed men	Men with sufficient income	Men with ≥ high school	Sex ratio	Employed men	Men with sufficient income	Men with ≥ high school
20	0.869	0.291	0.139	1.129	0.952	0.746	0.703	1.341
25	0.844	0.401	0.231	0.819	1.032	0.919	0.888	1.083
30	0.823	0.443	0.283	0.709	0.980	0.882	0.865	1.065
35	0.807	0.441	0.294	0.642	0.976	0.868	0.855	1.091
40	0.637	0.420	0.285	0.629	0.755	0.813	0.814	1.064
	Coloured				Indian			
20	0.936	0.439	0.306	1.315	0.854	0.609	0.545	1.136
25	0.936	0.559	0.419	1.002	0.974	0.820	0.756	1.021
30	0.894	0.567	0.437	0.969	1.248	1.097	1.014	1.349
35	0.868	0.548	0.417	1.007	0.933	0.787	0.745	1.127
40	0.684	0.503	0.381	0.866	0.695	0.710	0.694	1.154

B. Mate availability in the US 1992

	Afro-American			White		
Age	Sex ratio	Employed men	Men with sufficient income	Sex ratio	Employed men	Men with sufficient income
20	0.829	0.473	0.242	1.202	0.885	0.522
25	0.681	0.447	0.304	1.120	0.922	0.720

Note: Lichter et al (1992)'s definition of mate availability is based on unmarried men and women.

Source: Own computation based on Census 2001 and on 53 local areas; Lichter et al, 1992, Table 3.3 p.791.

In panel A of Table 3.3 are presented those of the 53 district councils with the highest sex ratios by population group for women 20 to 40 and in panel B are the ones with the lowest sex ratios. It shows that there is a larger supply of men in urban areas than in so-called tribal areas. Moreover these districts have a considerable influx of migrant labourers in general, since most of the mines, large commercial farms and other real or perceived work opportunities are there. Migrants workers are either accommodated in single sex hostels (not meant for families) or build informal shelters or shacks in the vacant lands close to their work place. For example, the West Rand has lots of worker hostels (more than 8% of the population in the DC constitutes of hostel residents) while the West Coast,

Overberg, Metsweding and Siyanda district councils have a large concentration of commercial farms (from 22 to 30% of the population in the DC constitutes of farm residents). Ekurhuleni and the West Rand have the highest numbers of informal settlements dwellers, 17% and 12% respectively of all informal settlement in the country (Census 2001).

Table 3.3: Local marriage markets ranked by ratio of men per woman

				African		White	
Rank	DC name	Province	DC type[17]	No. of women	All men/ women	No. of women	All men/ women
A. Top 10 sex ratios among Africans 2001							
1	Namakwa	Northern Cape	Urban area	1,074	1.588	2,493	1.055
2	West Coast	Western Cape	Urban area	7,451	1.300	10,116	1.032
3	Overberg	Western Cape	Urban area	10,596	1.270	7,322	0.898
4	West Rand	Gauteng	Urban area	153,306	1.257	31,746	1.009
5	Metsweding	Gauteng	Urban area	32,297	1.060	7,195	1.131
6	Eden	Western Cape	Urban area	24,194	1.009	18,911	1.008
7	Bojanala	North West	Tribal area	253,767	0.990	19,175	0.991
8	Ekurhuleni	Gauteng	Urban area	520,611	0.973	119,031	0.894
9	Siyanda	Northern Cape	Urban area	14,088	0.936	5,337	0.876
10	City of Johannesburg	Gauteng	Urban area	685,927	0.928	126,659	0.878
B. Bottom 10 sex ratios among Africans 2001							
1	Umzinyathi	KwaZulu-Natal	Tribal area	94,534	0.493	1,534	0.760
2	Sekhukhune	Mpumalanga	Tribal area	207,585	0.517	1,663	0.895
3	Bohlabela	Mpumalanga	Tribal area	134,718	0.525	994	0.849
4	O.R.Tambo	Eastern Cape	Tribal area	335,662	0.537	402	0.942
5	Umkhanyakude	KwaZulu-Natal	Tribal area	126,196	0.542	747	0.932
6	Vhembe	Northern Province	Tribal area	271,177	0.551	3,175	0.948
7	Alfred Nzo	Eastern Cape	Tribal area	106,734	0.557	17	0.638
8	Zululand	KwaZulu-Natal	Tribal area	168,893	0.565	3,033	0.858
9	Mopani	Northern Province	Tribal area	223,818	0.574	5,022	0.949
10	Sisonke	KwaZulu-Natal	Tribal area	62,208	0.586	1,405	0.880

Note: The totals include men aged 20 to 49 and women aged 17 to 46. Direct computations will give sex ratios slightly higher than those reflected in the table since these are averages by DC and are computed using equation 10.

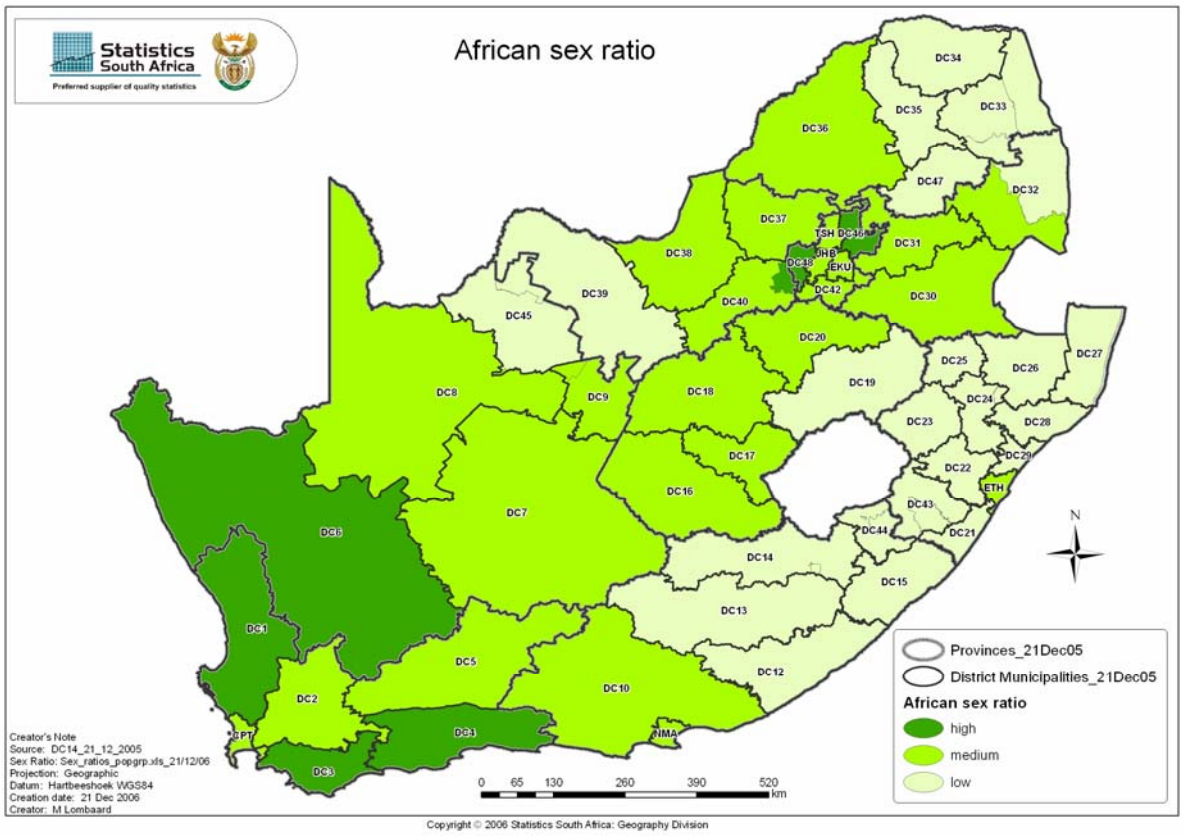
Source: Own computation based on Census 2001 and on 53 local areas.

[17] Derived from the dominant EA type within the DC. The ten EA types are: Tribal area; Urban area; Informal settlement; Farm; Smallholding; Industrial area; Recreational area; Institutions; Hostels; and Sparse (fewer than 10 households).

In panel B of Table 3.3 are presented DCs or metropolitan area that have the largest surplus of women in comparison to men. These are all rural areas with no or very few farms or towns. The deficit of men is the result of large-scale migration of men to urban and farm areas to seek employment. Thus from Tables 3.2 and 3.3, it is clear that men and women do not reside in the same areas of South Africa. For example, 45% of African males under the age of 20 live in rural areas, but this figure declines to only 39% by age 30. This trend begins to reverse itself after the age of 55, with almost 38% of males returning to their rural homelands by age 70 (Census 2001).

Figure 3.2 present the map of the sex ratios ranked from high- sex ratios, if the sex ratios are one or more, medium-sex ratios, if the sex ratios are 0.999 to 0.700 and low- sex ratios if the sex ratios are below 0.700 for Africans to better understand the geographical distribution of men and women in the country. The map shows that almost 50% of the DCs have low sex ratios except in the Western Cape and Gauteng where sex ratios are higher than 1.

Figure 3.2: Map of African sex ratios by district councils



Source: Own computation based on Census 2001 and on 53 district councils.

3.5 Empirical approach

We argue that a woman who has at least one child would order marital status in the following way, from the least attractive, 1) never married, through 2) unmarried cohabitation, and 3) traditional marriage, to the most attractive, 4) civil marriage. Among these institutional arrangements some are easier to enter and exit (particularly cohabitation). Civil marriage may be preferred over traditional marriage to avoid polygamy, although only 0.2 percent of African men live in official polygamous marriages. But men who are never married may have several sexual relations and thus be in practice polygamous. Traditional marriages have been legally acknowledged only since 1998 and give the woman the right to marital property.

We assume that the woman is a utility maximizer so that this ordering has to be understood as her preference other things being equal. With ordered alternative choices, any alternative is more similar to those close to it and less similar to those further away. The ordered nature can be handled by specifying an ordered probit model that accounts for the pattern of similarity and dissimilarity among alternatives. Other models such as the multinomial logit and multinomial probit models ignore the ordered nature of the data. The use of these models is also associated with undesirable properties, such as the independence of irrelevant alternatives in the case of a multinomial logit or lack of closed-form likelihood in the case of a multinomial probit (Greene, 2003).

In ordered probit, an underlying score is estimated as a linear function of the independent variables and a set of cut-off points or thresholds (Greene, 2003). The probability of observing outcome *j* corresponds to the probability that the estimated linear function, plus random error, is within the range of the cut-off points or thresholds μ_{j-1} estimated for the outcome. Let the underlying response model be described as:

$$Y^* = X'\beta + \varepsilon \tag{3.5}$$

where Y^* is an unobserved variable, X is a set of explanatory variables that are measurable factors and ε is the residual or error term. We observe that:

$$\begin{aligned} Y &= \text{sing}le && \text{if } Y^* < \mu_1 \\ Y &= cohabit && \text{if } \mu_2 < Y^* \le \mu_1 \\ Y &= married\ traditional && \text{if } \mu_3 < Y^* \le \mu_2 \\ Y &= married\quad civil && \text{if } \mu_3 \le Y^* \end{aligned} \tag{3.6}$$

The log-likelihood function for this model is given by (3.7):

$$L = \sum_{j=1}^{K} W_j \; e^{[\phi(\mu_j - X'\beta)\phi(\mu_{j-1} - X'\beta)]} \tag{3.7}$$

where j is the number of categories, W_j is an indicator variable and equal to 1 for a particular ordinal outcome and 0 otherwise.

The βs and μs are unknown parameters to be estimated. The Xs are the explanatory variables. In order to identify the parameters of the model, the normalization rule that var(ε)=1 is imposed. Thus ε ~IN(0,1). Thus we have the following probabilities:

$$\begin{aligned}
&\Pr(Y = \text{sin } gle \mid X) = \phi(\mu_1 - X'\beta) - \phi(-X'\beta) \\
&\Pr(Y = cohabit \mid X) = \phi(\mu_2 - X'\beta) - \phi(\mu_1 - X'\beta) \\
&\Pr(Y = married\ traditional \mid X) = \phi(\mu_3 - X'\beta) - \phi(\mu_2 - X'\beta) \\
&\Pr(Y = married\ civil \mid X) = 1 - \phi(\mu_3 - X'\beta)
\end{aligned} \tag{3.8}$$

For all the probabilities to be positive we must have $0 < \mu_1 < \mu_2 < \mu_3$. The interpretation of the model's parameter β is that positive signs indicate a more desirable marital status as the value of the associated variables increase, for example a higher probability of being in 'civil marriage', while negative signs suggest a less desirable status. These interactions must be compared to the ranges between the various thresholds, in order to determine the most likely marital choice for a particular woman.

Marriage market theory shows that the outcomes of marital choice depend on local marriage markets as well as women's own characteristics of the 'good catch' and 'self-reliance' effects. We use two strategies to explain racial differences in these outcomes. We first explain racial differences in a joint model for all population groups and enter dummy variables for population group. This procedure assumes no interaction between the population group and other explanatory variables. We then estimate separate models for Africans and Whites. This procedure allows all explanatory variables to have different effects in each population group. We then predict probabilities by simulating the effect of the marriage market on marital outcomes if African women were exposed to White women's marriage markets or had education levels similar to those of White women. To do so we calculate predicted probabilities by using formula 3.8 but assuming that African women had access to marriage markets with the characteristics of the White women's marriage markets. Therefore we calculate an index:

$$index = \sum_{i}^{n} \sum^{k-1} \beta_j X_{ij}^{african} + \beta_k X_{ik}^{white} \tag{3.9}$$

where k-1 variables of the n African women are multiplied by the estimated coefficients of the ordered probit. The kth variable is the marriage market indicator variable for example number of men divided by number of women in the local marriage market. For this variable we multiply the estimated coefficient from the ordered probit β_k with the marriage market characteristics which applies to Whites living in the same local marriage market as the African woman considered. We then used a formula supplied by STATA (StataCorp,

2003) to estimate the probabilities for African women for each of the four outcomes given that they had had access to marriage markets with the more female friendly White characteristics:

$$\Pr(Y = \text{sing}le \mid X) = norm(\_b[\_\mu_1] - index) \tag{3.10}$$
$$\Pr(Y = cohabit \mid X) = norm(\_b[\_\mu_2] - index) - norm(\_b[\_\mu_1] - index)$$
$$\Pr(Y = married\ traditional \mid X) = norm(\_b[\_\mu_3] - index) - norm(\_b[\_\mu_2] - index)$$
$$\Pr(Y = married\ civil \mid X) = norm(index - \_b[\_\mu_3])$$

3.6 Data and variables

The South African 2001 census is the second comprehensive census since the advent of democracy in 1994. Data collection was done by face-to-face interviews or self-completion of the questionnaires by respondents (Statistics SA, 2003). The complete census data at unit record level were used for analysis. Our a sub-sample of women aged 20 to 40 who had already given birth to their first child results in a sample size of 4.5 million women. Three groups of variables influencing the choice of marital status among women with at least one child are included: the available pool of marriageable men, exogenous variables and variables associated with the women's background, and economic status. Some of the variables may in some cases be endogenous to marital status. This is the reason for excluding them in some of our analysis. The first group of variables represents the local marriage markets at district council level.

Other controls used in the analysis are the woman's population group, age, religion, whether she lived in a metropolitan area and the local unemployment rate at the DC or metropolitan area level. These variables are considered purely exogenous. The DC level unemployment rate is estimated using unit record level Census 2001 data. The metropolitan municipalities include the six biggest metropolitan areas in South Africa-City of Cape Town Metropolitan Municipality; Ethekwini Municipality; City of Johannesburg Metropolitan Municipality; Ekurhuleni Metropolitan Municipality; Nelson Mandela Metropolitan Municipality; and City of Tshwane Metropolitan Municipality[18]. We also control for the woman's education and whether she was studying. The education classification is based on the highest level achieved, collapsed into four levels: none – no education; low – grade 6 or below; medium – grade 7 to grade 12; high – diploma or above. Another control is the woman's income, which has four categories: none – no income; low – income less than or equal to R3,200 per month; medium – income from R3,201 to R6,400 per month, and high – income of R6,401 or more per month. Further controls are employment status and whether the woman was living with her parents.

There is potential endogeneity with the woman's marital status, her current employment status, her education, whether she is studying, her income level and whether she lives with her parents. Some of the causality can run both ways, as the women may

[18] See footnote 14 for historical names of these places.

have changed their behaviour after their marriage. For instance, some women may decide to get a job to supplement their husband's income whereas others leave employment to be a full time housekeeper or homemaker after giving birth to at least one child. Some women may choose to live with their parents after they learnt that the father of their child is not marriageable.

The problems of endogeneity and reversed causality would have best been avoided by using panel or some historical data instead of the cross-section information we are using. However the use of the potentially endogenous variables can take care of the heterogeneity across women. For these reasons we run two different models: one with only exogenous variables and another with both exogenous and potentially endogenous variables.

The means and standard deviations of all variables included in the analysis are presented in Appendix Table A3.1.

3.7 Results

Table 3.4 presents results from estimating ordered probit models to establish the determinants of type of marital relationship entered into among South African mothers between the ages of 20 and 40. In model A, the marriage market indicator of the availability of employed men has a positive effect and population group is positive and significant with Whites and Indians more likely to have good marriages. The coefficient for age is positive and significant. Note that this result is by single year of age going from 20 to 30 means 0.069 which is not so small. Comparing 40 year old women to 20 years old women implies an increase by 20x0.069=1.38 which is a large coefficient close to the advantage White women have above African women and exceeding the coefficient for being Indian. The same reasoning applies for the unemployment rate. Going from the smallest unemployment rate 13.8 to the largest 68% means 44 percentage points difference, so 0.003x44=1.32 such that the probability of a good marriage is substantially increased in a low unemployment area. The interaction terms of employed and income are interesting since they are different in the distinct income intervals. The high income shows a coefficient of 0.145 and a standard error of 0.025, thus highly significant. This means other things equal, an employed woman with low income is less likely to be in a good marriage than an unemployed woman. But an employed woman with high or medium income is more likely to be in a good marriage than a woman who is not employed. Religious affiliation also contributes positively to marriage whereas women who reported having no religion are most likely to remain single. Living in a metropolitan area has a weak negative effect on marriages.

The thresholds presented at the lower end of Table 3.4 can be interpreted in terms of the Z-scores. The boundary between the marital statuses of 'never married' and 'cohabiting' is at Z=2.47; between 'cohabiting' and 'married traditional' at Z=2.85; between 'married traditional' and 'married civil' at Z=3.32.

Table 3.4: Ordered probit model of choice of marital status of South African mothers

	Model A		Model B	
	Coef	S.E	Coef	S.E
Number of employed men	0.523	0.005	0.333	0.006
Coloured	0.422	0.002	0.618	0.002
Indian	1.327	0.006	1.449	0.007
White	1.540	0.003	1.485	0.004
Age	0.069	0.000	0.055	0.000
Religion: Traditional	0.205	0.006	0.218	0.006
Judaism	-0.008	0.022	0.004	0.024
Hinduism	0.271	0.009	0.261	0.009
Islam	0.558	0.006	0.568	0.006
No religion	-0.066	0.002	-0.108	0.002
Metropolitan area	-0.019	0.001	-0.069	0.001
Unemployment rate of the area	0.003	0.000	0.003	0.000
Education: Low			0.053	0.002
Medium			0.123	0.002
High			0.366	0.003
Studying			-0.239	0.003
Employed			-0.126	0.007
Income: Low			-0.054	0.002
Medium			0.164	0.013
High			0.001	0.022
Employed*low income			-0.053	0.007
Employed*medium income			0.122	0.015
Employed*high income			0.145	0.025
Lives with parents			-1.576	0.002
Parameters of the model				
Thresholds: μ_1	2.472	0.006	1.627	0.007
μ_2	2.846	0.006	2.070	0.007
μ_3	3.315	0.006	2.587	0.007
Number of observations	4,565,849		4,565,849	
Log likelihood	-5076697.9		-4578396.7	
LR Chi square	1255701.43		2252303.76	
Likelihood ratio index	11.01%		19.74%	

Note: Reference categories for the explanatory variables: Population group - African; Religion - Christian; Education - None; Monthly income - No income.

Source: Own computation based on Census 2001

These values leave $\Phi(2.47) = 0.9932$ or 99% of the reference category in the 'never married' category; $\Phi(2.85) - \Phi(2.47) = 0.0046$ or 0.46% in the cohabiting category; $\Phi(3.32) - \Phi(2.85) = 0.0016$ or 0.16% in the 'married traditional' category and $1-\Phi(3.32) = 0.0006$ or 0.06% in the 'married civil' category. We notice a change in boundary probabilities when we use Model A and Model B, with 95% in the 'never married' category while the 'cohabiting' increase to 3% and the 'married traditional' and 'married

civil' categories to 1% each. These values are quite different from the observed proportions.

In model B of Table 3.4 potentially endogenous variables are added to the previous model to control for heterogeneity among women. Once more, all explanatory variables are all highly significant except for Judaism and income.

In Table 3.5 we present results of variations of Model A and B of Table 3.4 where the definitions of marriageable men have been varied in order to better gauge racial differences of the sex ratios on the population groups. Only the coefficients of the population groups are shown in the table but all variables presented in Table 3.5 have been used. In the first column, we present the model without the sex ratios to serve as a benchmark. The results are higher marriage rates among Indians and Whites than among Africans and Coloureds. Once we control for local marriage markets the effects decrease slightly for all population groups. African women's decisions to enter marriage are more dependent on the availability of employed men and to a lesser extent availability of educated men whereas for White women availability of men with sufficient income is more important. But in total the highest impact on the racial differences is made by the income-based local marriage market measure, a finding similar to Wood's (1995).

Table 3.5 : Results of ordered probits for population group in comparison to African mothers for various definitions of marriageable men

	No sex ratio	All men/ women	Employed men/women	Men with sufficient income/women	Men with ≥ high school men/women
A. Models					
Coloured	0.412	0.433	0.422	0.403	0.389
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)
Indian	1.478	1.463	1.327	1.272	1.428
	(0.006)	(0.006)	(0.006)	(0.007)	(0.006)
White	1.715	1.702	1.540	1.445	1.663
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
B. Models					
Coloured	0.611	0.619	0.618	0.605	0.597
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Indian	1.544	1.538	1.449	1.397	1.516
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
White	1.596	1.591	1.485	1.402	1.567
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)

Note: Number of observations: 4,565,849. Only the coefficients of the sex ratio are shown in the table but all variables presented in Table 3.4 have been used in the regression. Standard errors are given in parentheses.

Source: Own computation based on Census 2001

In Table 3.6 we present results of separate estimation for African and White women varying the definition of the sex ratios of marriageable men. The results for the

coefficients on the marriage market indicators are all positive and significant but availability of economically attractive men (men with sufficient income or employed men) contributes highly to the shift to a better marital state. Availability of educated men is also important for a good marriage among Africans whereas the effect is negative among Whites. Once more, the introduction of variables to control for heterogeneity among women in the regression reduces the effects of the sex ratios but the basic pattern remains.

Table 3.6: Effects of sex ratios of marriageable men in ordered probits by population group

	All men/ women	Employed men/women	Men with sufficient income/women	Men with ≥ high school men/women
A. Models				
All	0.215	0.523	0.598	0.168
	(0.005)	(0.005)	(0.005)	(0.004)
African	0.234	0.523	0.494	0.216
	(0.005)	(0.006)	(0.006)	(0.005)
White	0.494	1.466	1.571	-0.039
	(0.049)	(0.060)	(0.064)	(0.022)
B. Models				
All	0.083	0.333	0.434	0.094
	(0.005)	(0.006)	(0.006)	(0.004)
African	0.118	0.304	0.289	0.198
	(0.005)	(0.006)	(0.006)	(0.005)
White	0.409	1.086	1.136	0.022
	(0.050)	(0.062)	(0.066)	(0.023)

Note: Number of observations: all - 4,565,849; African - 3,721,535; White - 283,163.
Only the coefficients of the sex ratio are shown in the table but all variables presented in Table 3.4 have been used in the regression.

Source: Own computation based on Census 2001

In Table 3.7 we present simulated probabilities for four different outcomes of the effects of marriage markets using separate models for White and African women as presented in column 2 of Table 3.6 for employed men. We perform two simulations. First we give an African woman the marriage market characteristics of a White woman living in her district council and being of the same age as her. Second we shift the education level of the African woman upwards. This means that if the woman's observed level of education is 'none', she is assigned 'low' level in a one-level shift and 'medium' in a two-level shift. The one-level shift in education gives African women educational levels comparable to those of Whites. The distributions of observed and assigned levels of education are shown in Table A3.2 of the appendix.

Table 3.7: Probabilities for marital outcomes observed and predicted by using estimated behaviour and assuming African women would have marriage markets and education similar to White women

	White mothers		African mothers							
	Obs	Pred	Obs	Pred	Pred with White women's marriage markets	Pred with better education		Pred with both (5) and (6)	Pred with African mothers with at least high school education	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A. Models										
Single	0.058	0.058	0.506	0.508	0.414					0.379
Cohabit	0.064	0.065	0.135	0.135	0.138					0.054
Married traditional	0.018	0.018	0.165	0.166	0.187					0.085
Married civil	0.861	0.860	0.194	0.192	0.261					0.481
B. Models						One level	Two levels	One level	Two levels	
Single		0.058		0.511	0.467	0.510	0.439	0.433	0.366	0.362
Cohabit		0.066		0.134	0.134	0.135	0.133	0.133	0.126	0.052
Married traditional		0.017		0.163	0.171	0.163	0.175	0.177	0.182	0.087
Married civil		0.858		0.193	0.227	0.192	0.253	0.258	0.326	0.499

Note: 1. Number of observations: African - 3,721,535; White - 283,163;
2. The last column is based on the sample of African mothers who have at least high school education –244,167;
3. All the above results use employed men as the definition of a marriageable man.

Source: Own computation based on Census 2001

In Model A of Table 3.7, exposing African women to White women's marriage market increases the predicted probability of civil marriage by 7% (from 0.192 to 0.261) and the predicted probability of traditional marriage by 2% (from 0.166 to 0.187) which is a total increase of 9% of the predicted probability of marriage. If African women's education is shifted up by one level the effect on the predicted probability of marital status is negligible, whereas a shift of two levels increases the probability of marriage by 7%, with a 6% rise in the share of civil marriages only. Next we expose African women to a marriage market and educational levels similar to Whites. The result is that 44% of women would marry, out of which 26% would be in civil marriage. This is a rise in marriage rate of close to 8%. Lastly we expose African women to the White women's marriage market while at the same time shifting their education up by two levels, which is a much higher level than those of Whites. The result which is presented in column (9) of Table 3.7 shows that 51% of African women would marry (33% in a civil marriage and the rest in a traditional marriage).

However these rates still remain lower than those for White women. Hence we theorize that the reason probably is a social class issue rather than race issue. For these reasons, we predict marital outcome for high educated African women only. The result presented in the last column of Table 3.7 shows that 60% of women marry among which close to 50% marry in civil marriages. Thus high educated African women behave differently. These findings confirm that the racial differences are not solely due to the poor marital prospects of African women. Our results indicate that the conclusion holds even when we control for variables that may be related to marital choice decisions.

3.8 Conclusions

A comparison of plain sex ratios between African women and White women in South Africa shows that White women have better marriage markets. The marriage market worsens as the women become more selective. For example sex ratio as low as 30% applies for African women aged 35 if the requirement is that marriage candidates should earn above poverty income. The corresponding figure for White women is 86%. Using census data, this paper provides insights into the marital choices among women in South Africa taking into account the different types of marriage markets and the different population groups of the women. The findings can be summarized as follows. Better education increases the chances of women to be married. The availability of economically attractive men increases the opportunities for better marriages for all women. However African women in South Africa would have a civil marriage only if the man is employed, regardless of his income level. This is because there are fewer African men than women, but even fewer eligible African men and thus the men would most likely be very selective. If African women are assigned the same marriage markets as their White counterparts, the probability of marriage increases but not to the same level as for the White women.

In our study, all the women have at least one child, in most cases born out of wedlock. It is not uncommon for African couples first to have a child and to marry later as it takes a while to raise the lobola money. Thus what we observe may to some extent be postponement of marriage. Yet we include women until age 40 in our analysis. One of the apartheid legacies is to make the nuclear families difficult to be maintained. Instead there are families consisting of one parent, children and grandparents, a family which even now seems to be prevalent.

Research in the determinants of marriage rates among women in the US has shown the decline in marriage rates to be due to poor marriage markets as measured by the shortage of "quality marriageable" men. These studies suggest that even exposed to marriage market conditions similar to those of White women, Afro-American women are less likely to marry than their White counterparts. Among Afro-American women only 50% are expected to marry by age 28, compared to nearly 80% of White women (Lichter et al, 1992), which is a finding similar to ours. Moreover their finding indicates that the annual probability of first marriage among Afro-American women would increase by 23% if these women were exposed to the same marriage markets as those of White women, a figure still much lower than that for Whites. In addition, US findings have reported mate availability to be a significant factor contributing to delayed marriage among Afro-American women, and have shown that women with the greatest economic means the most likely to be married. This is consistent with our findings for South Africa.

Appendix

Table A3.1: Means and standard deviations of explanatory variables

Variable	Description	Mean	SD, Max, Min
Marital choice	Never married	0.46	
	Cohabiting	0.13	
	Married traditional	0.14	
	Married civil	0.28	
Sex ratio	Ratio of men per woman	0.79	(0.17; 6.50; 0.35)
No. of employed men	Ratio of employed men per woman	0.44	(0.21; 6.50; 0.05)
No. of educated men	Ratio of men with ≥ high school education per woman	0.74	(0.19; 9.25; 0.00)
No. of men with sufficient income	Ratio of men with income above R800 per woman	0.33	(0.21; 6.50; 0.02)
Population group based on self classification	African	0.81	
	Coloured	0.10	
	Indian	0.02	
	White	0.07	
Current age	Age in completed years	30.26	(6.3; 40; 20)
Religion (broad grouping)	Christian	0.83	
	Traditional	0.01	
	Judaism	0.01	
	Hinduism	0.01	
	Islam	0.01	
	No religion	0.13	
Metropolitan area	If the woman is currently staying in a big city	0.35	
Unemployment rate	Local unemployment rate	43.54	(11.03; 68.02; 3.83)
Highest level of education	None	0.12	
	Low	0.46	
	Medium	0.34	
	High	0.08	
Studying	If the woman is currently studying	0.07	
Employed	If the woman is employed	0.30	
Income	None	0.64	
	Low	0.29	
	Medium	0.06	
	High	0.01	
Employed*low income		0.23	
Employed*medium income		0.06	
Employed*high income		0.01	
Lives with parents	If the woman lives with her parents	0.25	
Number of observations		4,565,849	

Source: Own computation based on Census 2001.

Table A3.2: Distribution of ratio of men to woman by local area

District council	Province	DC type	African	Coloured	Indian	White	Overall
Alfred Nzo	Eastern Cape	Tribal area	0.557	1.147	0.536	0.313	0.638
Amajuba	KwaZulu-Natal	Urban area	0.697	0.916	0.908	0.958	0.870
Amatole	Eastern Cape	Tribal area	0.673	0.838	1.061	0.968	0.885
Bohlabela	Mpumalanga	Tribal area	0.525	0.702	1.103	1.065	0.849
Bojanala	North West	Tribal area	0.990	0.961	1.025	0.987	0.991
Boland	Western Cape	Urban area	0.922	0.853	1.084	0.863	0.931
Bophirima	North West	Tribal area	0.679	0.780	0.948	0.987	0.848
Cacadu	Eastern Cape	Urban area	0.812	0.798	0.801	0.923	0.834
Capricorn	Northern Province	Tribal area	0.589	0.718	1.315	0.946	0.892
Central	North West	Tribal area	0.713	0.908	1.192	1.014	0.957
Central Karoo	Western Cape	Urban area	0.900	0.792	0.444	1.063	0.800
Chris Hani	Eastern Cape	Tribal area	0.614	0.870	0.905	0.989	0.844
City of Cape Town	Western Cape	Urban area	0.837	0.822	0.897	0.915	0.868
City of Johannesburg	Gauteng	Urban area	0.928	0.791	0.888	0.904	0.878
City of Tshwane	Gauteng	Urban area	0.875	0.790	0.908	0.891	0.866
Eden	Western Cape	Urban area	1.009	0.816	1.258	0.950	1.008
Ehlanzeni	Mpumalanga	Tribal area	0.742	0.782	1.161	0.955	0.910
Ekurhuleni	Gauteng	Urban area	0.973	0.788	0.904	0.913	0.894
Ethekwini	KwaZulu-Natal	Urban area	0.780	0.803	0.861	0.928	0.843
Frances Baard	Northern Cape	Urban area	0.821	0.805	0.934	0.955	0.879
Govan Mbeki	Mpumalanga	Urban area	0.799	0.968	0.968	0.973	0.927
Karoo	Northern Cape	Urban area	0.876	0.855	0.677	1.004	0.853
Kgalagadi	Northern Cape	Tribal area	0.648	0.872	0.482	1.045	0.762
Lejweleputswa	Free State	Urban area	0.869	0.837	1.345	0.939	0.997
Metsweding	Gauteng	Urban area	1.060	1.446	0.992	1.026	1.131
Mopani	Northern Province	Tribal area	0.574	0.926	1.340	0.958	0.949
Motheo	Free State	Urban area	0.765	0.842	1.212	0.842	0.916
Namakwa	Northern Cape	Urban area	1.588	0.852	0.795	1.055	1.073
Nelson Mandela	Eastern Cape	Urban area	0.795	0.814	0.934	0.939	0.870
Nkangala	Mpumalanga	Urban area	0.796	0.845	1.003	0.954	0.899
Northern Free State	Free State	Urban area	0.897	0.962	1.158	0.958	0.994
Oliver R.Tambo	Eastern Cape	Tribal area	0.537	0.923	0.939	1.369	0.942
Overberg	Western Cape	Urban area	1.270	0.922	0.407	0.993	0.898
Siyanda	Northern Cape	Urban area	0.936	0.809	0.767	0.993	0.876
Sedibeng	Gauteng	Urban area	0.850	0.850	0.929	0.953	0.896
Sekhukhune	Mpumalanga	Tribal area	0.517	0.767	1.291	1.003	0.895
Sisonke	KwaZulu-Natal	Tribal area	0.586	0.902	1.015	1.019	0.880
Southern	North West	Urban area	0.903	0.783	0.864	0.883	0.858
Thabo Mofutsanyane	Free State	Urban area	0.666	0.933	1.125	0.934	0.915
UMgungundlovu	KwaZulu-Natal	Urban area	0.698	0.842	0.874	0.895	0.827
Ugu	KwaZulu-Natal	Tribal area	0.597	0.733	0.859	0.925	0.778
Ukhahlamba	Eastern Cape	Tribal area	0.650	0.876	0.917	1.018	0.865
Umkhanyakude	KwaZulu-Natal	Tribal area	0.542	1.026	1.030	1.129	0.932
Umzinyathi	KwaZulu-Natal	Tribal area	0.493	0.778	0.882	0.885	0.760
Uthukela	KwaZulu-Natal	Tribal area	0.608	0.788	0.892	0.977	0.816
Uthungulu	KwaZulu-Natal	Tribal area	0.639	0.871	0.968	1.000	0.869
Vhembe	Northern Province	Tribal area	0.551	0.705	1.547	0.989	0.948
Waterberg	Northern Province	Tribal area	0.749	0.873	0.881	0.957	0.865
West Coast	Western Cape	Urban area	1.300	0.903	1.155	1.032	1.097
West Rand	Gauteng	Urban area	1.257	0.844	0.993	0.940	1.009
Xhariep	Free State	Urban area	0.912	0.866	0.464	1.053	0.824
Zululand	KwaZulu-Natal	Tribal area	0.565	0.898	1.049	0.918	0.858
iLembe	KwaZulu-Natal	Tribal area	0.635	0.870	0.828	1.001	0.834
Mean			0.788	0.862	0.957	0.963	0.892
Min			0.493	0.702	0.407	0.313	0.638
Max			1.588	1.446	1.547	1.369	1.131
1st quartile			0.614	0.792	0.874	0.928	0.849
Median			0.765	0.845	0.934	0.958	0.879
3rd quartile			0.900	0.902	1.084	1.003	0.931

Source: Own computation based on Census 2001

Table A3.3: Distribution of sex ratios for all definitions of marriageable men

	African				White			
Measure	All men	Employed men	Men with sufficient income	Men with ≥ high school	All men	Employed men	Men with sufficient income	Men with ≥ high school
Mean	0.788	0.402	0.271	0.732	0.963	0.865	0.857	1.071
Min	0.493	0.118	0.088	0.478	0.313	0.260	0.223	0.095
Max	1.588	1.240	0.758	2.206	1.369	1.181	1.197	1.442
1st quartile	0.614	0.242	0.158	0.619	0.928	0.821	0.825	1.006
Median	0.765	0.386	0.244	0.682	0.958	0.869	0.852	1.079
3rd quartile	0.900	0.507	0.348	0.773	1.003	0.920	0.904	1.140

Source: Own computation based on Census 2001 and on 53 district councils

Table A3.4: Distribution of men aged 20-49

	African		White	
(in Thous)	N	%	N	%
Employed	2,331	40.5	555	83.5
Income >R800 or more	1,506	26.2	544	81.8
Men with ≥ high school	1,778	30.9	125	81.2

Source: Own computation based on Census 2001

Table A3.5: Educational distribution by population group

Education level	White	African		
	Observed	Observed	Moved one level up	Moved two levels up
None	0.008	0.140		
Low	0.180	0.465	0.140	
Medium	0.507	0.329	0.465	0.140
High	0.304	0.066	0.395	0.860

Source: Own computation based on Census 2001

Chapter 4

Educational Attainment Differences Between Population Groups in South Africa and the Timing and Number of Births

4.1 Introduction

Education of women may be one of the most important investments which allow women to invest further in their human capital and higher educated women have wealthier and more educated children who can invest in their own human capital, which benefits economic development (Schultz, 1997). South Africa's reform of the education policies in the mid 1990s aimed at equal access to educational institutions to all citizens may therefore not only serve as a way to improve the quality of life of women and their families in terms of opportunities and financial wellbeing but also yield long run benefits as they will invest more in the education of their children. Economic theory and empirical evidence suggest that the so called quantity-quality trade-off in fertility decisions plays an important role in the relationship between the educational attainment of a woman and her children (Becker 1981, 1991; Cigno 1991; Gustafsson, 2001 Ermisch, 2003; Gustafsson and Kalwij, 2006). This trade-off implies that higher educated families not only have more resources to spend on the education of their children but have fewer children as well and, consequently, invest relatively more in them compared to lower educated families.

This chapter's objective is to obtain insights in how the educational expansion in South Africa may affect fertility behaviour. In particular, this chapter examines in detail if an

increase in the educational attainment of women in South Africa delays the timing of births and reduces the number of children. Such a result would be compatible with the quality-quantity trade-off that yields relatively higher human capital investments in the next generation. Of particular relevance to South Africa is that there is still a considerable variation in both educational attainment and completed fertility between the population groups (see Figures 4.1 and 4.2 below). For this reason this chapter also examines in detail to what extent the educational differences can explain the differences in the timing and number of births between the population groups.

Fertility has decreased earlier and more rapidly among African South Africans than in any other Sub-Saharan country to 3.0 in 2005 (Statistics South Africa, 2005). One hypothesis why South Africa's fertility has decreased more is that mass education came earlier than in other Sub-Saharan countries with 81% of the population 15-19 having at least 6 years of education in 2001 (Lloyd, Kaufman and Hewett, 2000; Census 2001). Caldwell and Caldwell (1993) point to the availability of family planning programmes that are of the 'Asian type', clinics providing services almost entirely to married women, and thus the high prevalence of contraceptives supplied free of charge by the government to every women who desires to make use of them. The early success of contraception would not have come about if there had not been a demand for contraceptives by the African women themselves. During the apartheid era, an African woman who had a job and a work permit in the city would risk losing her job due to pregnancy and would not be allowed to keep her child with her in the city. Thus she had to leave her child in the homeland or Bantustan in the care of her mother or other relatives in order to continue to work in the city. Also there is a small dependence pressure on fathers who often get away without supporting their children, thus the mother is usually the sole provider for her children. The Apartheid government used the clinics in their propaganda to decrease population growth among African and coloured people[1] (Preston-Whyte et al, 1991).

In developed countries, analysis of fertility has often been done jointly with analysis of female labour supply (Willis, 1973; Bloemen and Kalwij, 2001). A recent study on South Africa (Lam and Anderson, 2002) shows convincingly that only at more advanced education levels of women does labour force participation increases. This insight justifies the use of education as the main explanatory variable for the quantity-quality trade-off even if one does not have information on the work histories of women.

In this chapter, we use the 2002 General Household Survey data (GHS) to analyze the timing of births and completed fertility in South Africa for the four population groups

[1] During apartheid, the Afrikaner-dominated National Party government advanced separate population policies for Whites and non-Whites, due to fear of unsustainable population growth. This fear took on racist overtones manifested in propaganda suggesting that the non-White population was growing too quickly while the growth rate of the White population was stagnating, and that the African and Coloured populations were becoming a burden upon the country's resources. Thus population policies focused mainly on fertility reduction, restricted population movement, controlled settlement and development patterns that excluded others than Whites from making free choices.

distinguished by self-classification: African, Coloured, Indian and White. We estimate multi-spell duration models and perform simulations on the basis of the model to obtain insights in completed fertility. The remainder of this chapter is organised as follows. The second section presents the data set and variables used. Section 4.3 discusses trends in fertility and education in South Africa. Section 4.4 presents the empirical model and section 4.5 discusses the estimation results. Section 4.6 discusses simulation results and lastly section 4.7 concludes.

4.2 Data and variables

The General Household Survey (GHS) is conducted by Statistics South Africa around July each year. The sample is drawn from the master sample[2] and consists of 30, 000 dwelling units (Statistics South Africa, 2003). In the GHS 2002, full reproductive history data is collected among women who had at least one live birth regardless of whether the child lives with the mother or not. We include women born in 1952 to 1984 that is women aged 18 to 50 in 2002. The lower age limit of 18 is used because these women are old enough to be able to have completed at least 12 years of schooling and the higher age limit of 50 is used because data is not collected on older women. Our sample includes 27,367 women.

Along with the fertility data, information on the characteristics of the women and everyone living in the household are available in the data. Population group by self-classification into African, Coloured, Indian and White is our key variable of interest together with education of the woman. Population group is a major issue in South Africa. We cannot study income differences, educational differences or fertility without taking account of the racial differences since the African population has started from a disadvantaged level because they historically had limited access to education. When democracy was achieved in 1994, the government introduced much needed reforms after decades of educational policies that discriminated against Africans. Introduced in 1996, the National Education Policy Act and the South African School Act[3] guarantee equal access to educational institutions to all citizens, the right to basic education and compulsory education for children aged 7 to 15 or up to grade 9. These laws also serve to redress past injustices in the allocation of educational resources as well as providing a uniform system for governance and funding of schools.

In the GHS, the schooling information is collected as the current highest completed educational level. We aggregated the education variable into six groups. First, 'no schooling'

[2] The master sample is drawn from the database of enumeration areas (EAs), as was established during the demarcation phase of census 1996. As part of the master sample, small EAs consisting of fewer than 100 dwelling units are combined with adjacent EAs to form primary sampling units (PSUs) of at least 100 dwelling units, to allow for repeated sampling of dwelling units within each PSU. The sampling procedure for the master sample involves explicit stratification by province and within each province, by urban and non-urban areas. Independent samples were drawn from each stratum within each province. The smaller provinces were given a disproportionately larger number of PSUs than the bigger provinces.

[3] South African Government, 1996, Act No. 27 and Act No. 84, Government Gazettes.

includes those with No Schooling, Grade R or Grade 0. Second, those with Grades 1 to 7 or SubA to Standard 5 are classified as 'primary'. Third, those with Grades 8 to 11 or Standard 6 to 9 including NTCI, NTCII and NTCIII are classified as 'some secondary school'. Fourth, those with Grades 12 or Standard 10 or Matric (which is also known as the Senior Certificate in South Africa) are classified as 'high school' and are equivalent to the high school diploma in the United States. Fourth, those with Diploma or Certificate are classified as 'diploma' and those with Degree or Postgraduate Diploma are classified as 'degree'[4]. Our classification thus distinguishes those who completed high school from those who dropped out from high school.

We do not have data on the woman's family background such as parents' education and the number of siblings. Nine provincial dummies define region. We know the sex of the children. In addition, we define teenage birth as birth that occurred when the woman was below 20. We know the full fertility history of the woman also if and when any child has died. Therefore we know whether the woman had a child death prior to the birth we study. There is information about income, marital status and employment status in 2002 but there is no retrospective information on these variables. We do not know what her income and employment status were before and after a child was born. While the date of birth of the child is collected, the age of the mother instead of her date of birth is collected. This makes it impossible to use months as our duration variable and thus we use years. Means and standard deviations of the variables discussed above are presented in appendix Table A4.1.

4.3 Descriptive statistics on fertility and education in South Africa

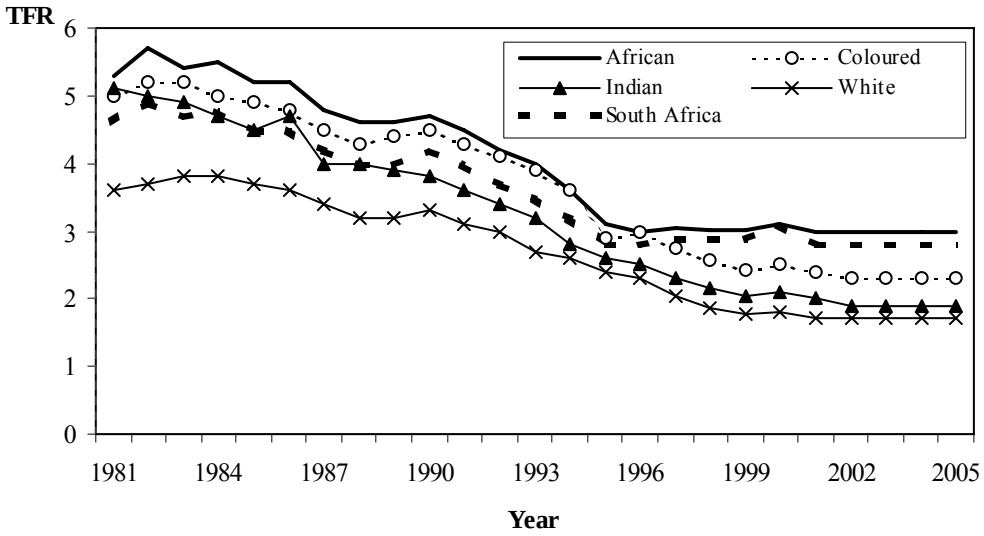
In the Apartheid period, population counts were made by using a combination of sampling and aerial photographs of African residential areas and no census interviews among Africans were made. It was therefore difficult to get reliable information on fertility. However, Sibanda and Zuberi (2005) estimate fertility rates by reconstruction of birth histories using the census of 1996 and we present their estimates in Figure 4.1. South Africa has a population of 47.4 million people according to the 2006 mid-year population estimates with an overall growth rate of 1.06% (Statistics South Africa, 2006). In comparison population growth in 2006 is estimated to be 0.70% in Sweden[5], 0.60% in the United Kingdom[6] and 0.97% in the United States[7], 3.5% in Uganda and 2.2% in Nigeria[8].

[4] Grade R stands for Reception year is also referred to as Grade 0, NTC stands for National Technical Certificate, NTCI is equivalent to Grade 8, NTCII is equivalent to Grade 9 and NTCIII is equivalent to Grade 10. Grades used to be referred to as Standards in the old school system.
[5] Statistics Sweden, http://www.scb.se/templates/tableOrChart_25897.asp
[6] Office for National Statistics , http://www.statistics.gov.uk/cci/nugget.asp?id=6
[7] US Bureau of Census , http://www.census.gov/popest/states/tables/NST-EST2006-06.xls
[8] World Bank, http://www.worldbank.org, figures quoted for 2005

Figure 4.1 shows that there is a fast decline in fertility rates among all population groups in South Africa. The total fertility rate (TFR) of South Africa has been reduced by almost a half from an estimated level of 4.6 in 1981 to an estimated level of close to 2.8 children per woman in 2005 which is slightly higher than the replacement level TFR for South Africa (2.57) as estimated by Engelman and Leahy (2006). The decline has been sharp until the early 1990s and has then levelled off at around 3 children per woman. Although all population groups show a similar pattern of fertility decrease, fertility is still highest among Africans followed by the Coloureds.

Education is currently reaching all children in South Africa between the ages of 7 to 15 and the proportion of African young people who graduate with the senior certificate examination (Matric) has increased steadily. We computed average completed years of education by women's birth cohort from the GHS 2002 as shown in Figure 4.2. Education increases over time for all population groups, the highest increase being among Africans and Indians, indeed showing a narrowing of educational levels between population groups, although convergence has not been achieved, even for the youngest cohort born in 1980-1984.

Figure 4.1: Trend in fertility in South Africa

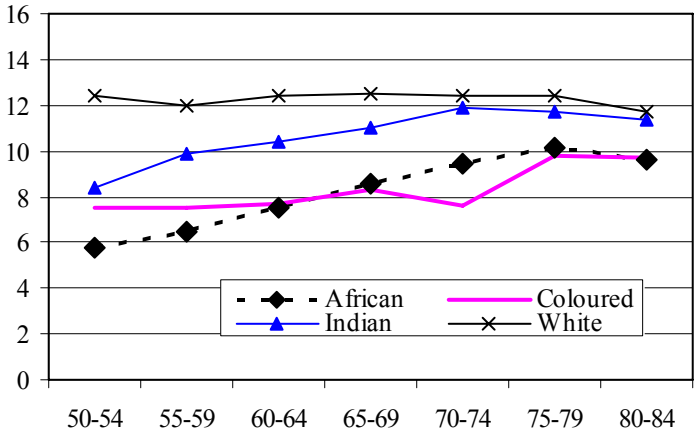


Sources: p.71, Zuberi et al eds, 2005 for estimates from 1981 to 1996; Mid-year population estimates 2004, Statistics South Africa; Mid-year population estimates 2005, Stats SA for estimates 1997 onwards; National values for 1997,1998 and 1999 were imputed.

The trends shown in Figure 4.2 are in line with Thomas (1996) who uses the 10% sample of the 1991 South African census data and shows similar educational trends. He runs quantile regressions and finds that among Africans the increase in years of education has been mostly

among those relatively well educated whereas the least educated have not increased their education over time. This is in contrast to Coloureds, Whites and Indians where the least educated have increased their education the most. This result of Thomas shows that looking at means such as in Figure 4.2 may not tell the whole story.

Figure 4.2: Women's average years of schooling by population group and birth cohort



Source: General Household Survey 2002

From the GHS 2002, we computed proportions of all births by birth order for African and White women as presented in Table 4.1. It is clear that African women are much more likely to be teenage mothers than are White women. Among African women, 47.6% of first births occur to women 19 years old or younger, while the corresponding number among White women is 16.5%. Garenne et al (2001) study a rural region[9] for the period 1992-1997 and distinguish between premarital births that account for 21% of all births and peak at age 18-20 and for 47% of all births to women aged 12-26 as opposed to marital fertility that peak around age 28-30. They observe a marked increase in the use of contraceptives once first birth has occurred, ten times more than among teenagers and younger women who had not yet had a first birth.

In Table 4.1, we find that among African women who give birth to their first child, 37.6% are never married as compared to 2.1% among Whites. This is an even larger share than the

[9] They study the Agincourt region situated in Limpopo province and is adjacent to South Africa's border with Mozambique. The study carried out by a team from Witwatersrand University's Health Systems Development Unit is based on 65,000 people and is possibly representative of rural South Africa.

one estimated by Garenne et al (2001) who for the rural Agincourt region found that 21% of first births were premarital. This is in accordance with the many very young first time mothers, several of whom probably are never married. In chapter 3 of this dissertation, using the 2001 census of South Africa we find that among African women aged 20-40 who have at least one child, 48% are never married.

Table 4.1: Proportion of births by birth order, age at giving birth, and marital status

	African				White			
	1st	2nd	3rd	4th+	1st	2nd	3rd	4th+
By age at giving birth								
<15	4.3	0.3	0.1	0.0	0.5	0.1	0.0	0.0
15-19	43.3	14.0	4.2	0.4	16.0	4.3	2.9	0.0
20-24	37.1	43.9	27.4	5.4	42.2	30.1	17.0	6.2
25-29	11.4	28.4	40.8	24.6	28.6	41.4	37.5	35.1
30-34	2.9	10.1	19.8	36.8	9.7	19.2	33.7	40.2
35-39	0.7	2.7	6.2	23.9	2.4	4.2	8.4	15.5
40-44	0.2	0.6	1.3	8.0	0.6	0.6	0.6	3.1
45-49	0.0	0.1	0.1	0.9	0.0	0.1	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
By marital status								
Never married	37.6	24.3	16.1	11.7	2.1	0.5	0.3	1.0
Married/cohabiting	52.6	63.4	70.2	74.5	86.9	88.5	87.9	81.4
Separated/divorced	9.8	12.4	13.7	13.8	11.0	11.0	11.8	16.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Own computation based on GHS 2002

One previous study, Gangadharan and Maitra (2001) find no differences between population groups in average age at first birth[10]. We think Gangadharan and Maitra may have errors of measurements in their age at first birth variable[11].

[10] Based on the GHS 2002 we find age at first birth for Africans to be 21.6; for Coloureds to be 22.2; for Indians to be 23.8 and for Whites to be 25.1, while Ganghadaran and Maitra (2001) find age at first birth to be 23.11 for Africans, 23.43 for Coloureds, 23.35 for Indians and 23.43 for Whites, using the South African Integrated Household Survey (SIHS) 1993.

[11] Quoting from p.184, "The respondents in the SIHS survey were not asked about their age at first birth. The age at first birth therefore had to be computed from available data. Every member of the household was asked the identification code of his or her mother. We use this information to match each mother to all her children. This way we were able to obtain the childbearing history of women who have at least one child who is alive at the time of the survey". It is possible that first-born children who have left the households or have died would be missed out and no estimation is given as how likely it is that people know their mother's identification code.

4.4 Empirical model

Most past studies on fertility are based on a static formulation of the demand for children. As discussed in the introduction, the main objective of this chapter is to study the effects of education and population group on the timing of births and completed fertility. For this purpose we are exploiting recent individual fertility history data for South Africa to estimate a dynamic model of lifetime fertility for all South African women aged 18-50 in 2002. In addition we also study the effect of child mortality on subsequent fertility, birth cohort effects and regional differences in lifecycle fertility. To examine these issues the empirical analysis consists of two parts. The first part is the estimation of a hazard rate model for the timing of births and the second part is a simulation model for obtaining insights in (age specific) completed fertility.

The first part of the empirical analysis sets out to estimate the effects of the covariates on the timing of births. For this purpose we estimate Cox proportional hazard models for each birth. The advantage of this approach is that it imposes no specific functional form of the pattern of duration dependence. The hazard for a transition from having k to having (k+1) conditional on the covariates is specified as follows:

$$\lambda_k(t_k \mid X_k(t_k); \beta_k) = \lambda_{k0}(t_k)\exp(X_k(t_k)'\beta_k) \tag{4.1}$$

where k denoted the number of children present in the household (e.g. k=1 is the situation of having given birth once and being at risk of giving birth to the second child), t_k is the years the woman is at risk of giving birth to the $(k+1)^{th}$ child (i.e. elapsed duration), $\lambda_{k0}(.)$ is the baseline hazard function, exp(.) is the exponential function, $X_i(t_k)$ is a vector of covariates which are allowed to be time-varying, and β_k is a parameter vector. The time-constant covariates included are educational attainment, population group, birth cohort and region. The time-varying covariate is an indicator on whether or not a child has deceased. The model is estimated by maximizing the partial log-likelihood functions for each birth. The parameter vector β_k is allowed to be different up to the fourth birth. This means that for five and more births this parameter vector, and the baseline hazard function, is assumed to be the same as for the fourth birth up to a constant that depends on the number of births. The estimation results are presented as hazard ratios.

The parameter estimates of the Cox proportional hazard models provide insights in the direction and relative size of the effects of the covariates on the hazard of giving birth. These do not, however, provide insights in the effects on lifecycle fertility, and in particular do not provide much insight in completed fertility. For this reason the second part of the empirical analysis sets out to simulate lifecycle fertility patterns and examines how these patterns are affected by the covariates that are included in the model.

The Monte Carlo simulations are carried out as follows. For a group of reference women (the baseline) we start the simulation at age 12. We arbitrarily choose the characteristics of the reference women that they are born between 1960 and 1964, have some secondary education, are African and are living in KwaZulu-Natal. Based on the parameter estimates we can calculate for each woman the probability that she will give birth within that year and based on a random draw from the uniform distribution we can simulate for each woman whether or not she gives birth (see e.g., Law and Kelton, 1982). Subsequently, using the estimated hazard rates, and given the past fertility outcomes, year-by-year births are simulated for each woman until the age of 40. The statistics presented are means of this homogenous group of women. For example, based on the simulation outcomes we can calculate the average number of children these women have at the age of 25. The Monte Carlo simulations are carried out for 1,000 women and 200 replications from the asymptotic distribution around the parameter estimates are drawn to construct standard errors.

A consequence of using a Cox proportional hazard model is that we do not have standard errors for the baseline situation since duration dependence is non-parametrically modelled. We can only provide standard errors on the differences from the baseline situation. For example, the reference woman is an African woman and based on the simulation results we can calculate the difference in the (expected) number of children between an African and an Indian woman, given that all other characteristics are the same. In addition we can provide a standard error with it and test whether or not this difference is significantly different from zero. These differences are calculated for all covariates we control for in the model and for all age groups. In addition, we can provide estimates of the replacement responses to fertility due to child mortality.

4.5 Estimation results

Table 4.2 presents the estimation results of the hazard model outlined above. The hazard ratio is a relative risk where the risk is defined as the probability of giving birth conditional on the observed covariates and the time (years) since the last birth. If the coefficient of the hazard ratio is 0.5, then the relative risk of giving birth in that group defined by one of our explanatory variables is half the risk of giving birth in the reference group. A ratio below 1 indicates a longer duration, hence delaying birth, and any value above 1 indicates an increased risk, meaning scheduling birth earlier.

Statistically significant population group differences in the age at first birth can be noted in Table 4.2 contrary to what is found by Gangadharan and Maitra (2001). This is seen as hazard ratios below 1 for Indian and White women in comparison to the reference population group which is African women. The z-values are well below –2 which means that they are statistically different from the reference category.

The reference cohort is women born 1960-1964. The cohort pattern shows an inverted U-shape for first birth with earlier cohorts and later cohorts having hazard ratios below 1, which means they are waiting longer to become mothers than the reference cohort. The youngest cohort, those born in 1980-1984 have a very low hazard ratio 0.552, but this ratio is also affected by the fact that the women in that age group are 18 to 22 years old in 2002 when the data are collected. Many first births for this cohort have yet to occur and would increase the hazard ratio if we observed them later. This is one reason why we perform simulation analyses below so that we can compare 18 year olds of different cohorts.

The higher the education of the woman the lower the hazard ratios for first time births except when comparing 'no school' to having 'completed primary education'. The reference category for schooling is 'some secondary education'. The hazard ratios for first births are a composite of a larger number of higher educated women remaining childless and higher educated women having their first births at a later age. In the simulations below we will separate between these two effects. The hazard ratios for second births, third births and fourth or higher births are to be interpreted similarly to the hazard ratios of the first birth.

4.6 Simulation results

The effect of education in the model other things being equal is presented in Table 4.3. The table reads in the following way: on the left are results for the reference woman who is African, has some secondary school but has not competed grade 12, born in 1960-1964 and living in KwaZulu-Natal and whose child does not die. We then compute differences from the reference woman by varying educational attainment only and keeping the other characteristics of the reference group constant. We focus our discussion on the educational differences at age 36-40 because Panel A in this age group will be an estimate of ultimate childlessness for those women who have not yet had a first birth, while Panel B will be an estimate of the total number of children that the woman has. Very few births occur after age 36, therefore we do not miss that many first births by making the average in age groups 36-40 as estimate of ultimate childlessness (see Table 4.1 above). However higher order births do occur to older women e.g. 8.9% of fourth and higher order births to African women according to Table 4.1 above. Therefore interpreting expected number of births in age group 36-40 includes some

Table 4.2: Estimation results

	First birth		Second birth		Third birth		Fourth or more births	
	Haz. ratio	z-value	Haz. ratio	z-value	Haz. ratio	z-value	Haz. Ratio	z-value
By population group								
Coloured	1.033	1.08	0.990	-0.26	0.875	-2.53	0.760	-4.76
Indian	0.845	-3.33	1.289	4.17	0.670	-4.57	0.388	-6.31
White	0.797	-7.35	1.404	9.18	0.510	-10.87	0.421	-8.16
By cohort								
Born in 1950-1954	0.789	-6.91	1.043	1.14	1.152	3.28	1.073	1.92
Born in 1955-1959	0.960	-1.50	0.968	-1.12	1.092	2.53	1.041	1.33
Born in 1965-1969	1.037	1.43	0.899	-3.79	0.893	-3.19	0.901	-2.94
Born in 1970-1974	0.911	-3.70	0.754	-9.57	0.712	-8.17	0.739	-5.72
Born in 1975-1979	0.767	-9.87	0.489	-18.91	0.440	-11.16	0.458	-5.05
Born in 1980-1984	0.552	-19.29	0.251	-19.68	0.265	-5.89	0.307	-1.73
By education								
No school	0.812	-6.67	1.086	2.71	1.304	6.60	1.382	9.52
Primary	1.013	0.59	1.148	5.41	1.176	5.15	1.311	9.59
High school	0.699	-16.97	0.773	-9.30	0.791	-5.45	0.752	-5.49
Diploma	0.633	-14.04	0.856	-4.06	0.783	-4.31	0.791	-3.42
Degree	0.539	-13.05	0.939	-1.15	0.796	-2.61	0.744	-2.65
By region								
Western Cape	1.012	0.34	1.037	0.81	0.947	-0.89	0.697	-5.53
Eastern Cape	0.985	-0.53	1.070	1.86	1.098	2.04	1.065	1.55
Northern Cape	1.007	0.15	0.967	-0.64	0.882	-1.74	0.754	-3.77
Free State	1.079	2.32	1.032	0.77	0.820	-3.70	0.698	-6.96
North West	1.159	4.86	1.016	0.42	0.841	-3.47	0.683	-7.77
Gauteng	0.945	-2.00	0.918	-2.40	0.787	-4.93	0.700	-7.13
Mpumalanga	1.198	5.80	1.023	0.57	0.995	-0.09	0.979	-0.46
Limpopo	1.416	12.14	1.185	4.76	1.088	1.87	0.986	-0.36
Other controls								
Had teenage birth			1.214	9.76	1.291	9.53	1.201	6.90
Previous born is male(s)			1.009	0.49	1.087	2.81		
Previous born is female(s)					1.098	3.11		
Four children							0.824	-7.61
Five children							0.849	-4.41
Six children							0.841	-3.19
Seven or more children							0.876	-1.82
First child died			2.033	11.33	1.738	7.40	1.240	4.16
Second child died					1.770	6.83	1.312	4.85
Third child died							1.403	5.15
Parameters of the model								
Num. of observations	27,364		17,578		11,694		6,781	
Time at risk	289,790		116,821		84,052		86,504	
Log Likelihood	-164255.65		-104264.16		-58342.94		-65914.08	
Likelihood ratio χ^2	1736.34		1546.11		1303.35		1152.69	

Note: Reference: African, cohort 1960-1964, some secondary school, KwaZulu-Natal.

Source: Own computations based on GHS 2002.

underestimation but we nevertheless think about this statistics as completed number of children. In TFR like Figure 4.1 above computations, age 49 is the cut off age.

Comparing the reference case in Panel A where ultimate childlessness amounts to 10% (i.e. 1-0.901) to a similar woman belonging to the same population group, the same cohort, the same residential region, and to whom no child has died but who has completed a university degree shows that childlessness is much higher as has been found in many other studies e.g. Gustafsson, Kenjoh and Wetzels (2002) for Britain, Sweden, Germany and the Netherlands. Our results in Table 4.3 show that the probability of having at least one child decreases by 0.699 (from 0.901 to 0.202) that is 30% of such women would be childless at age 36-40. Examining Panel A, we observe that the higher educated women have less negative differences at age 36-40 than they have at age 26-30. This decreasing negative effect is an estimate of the 'catching up' effect for higher educated women for first birth. In Panel B comparing once more the reference case of having some secondary education to having completed a university degree shows that the woman with some secondary education averages 2.7 children while the woman with a university degree averages 1.7 children.

Table 4.3: Educational effect on fertility outcomes

Reference woman		Differences from the reference									
	Secondary	Primary		High school		Diploma		Degree		No schooling	
Age group		Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value
A. Probability of at least one child											
12-15	0.030	0.000	0.34	-0.010	-17.35	-0.011	-33.09	-0.014	-24.77	-0.005	-5.81
16-20	0.290	0.002	0.36	-0.078	-19.60	-0.100	-18.99	-0.130	-16.09	-0.040	-6.67
21-25	0.668	0.003	0.39	-0.125	-19.63	-0.168	-14.54	-0.230	-16.81	-0.066	-6.87
26-30	0.830	0.003	0.45	-0.131	-21.50	-0.171	-15.83	-0.234	-17.84	-0.069	-5.76
31-35	0.884	0.002	0.29	-0.117	-20.86	-0.156	-14.69	-0.217	-17.95	-0.065	-5.85
36-40	0.901	0.001	0.21	-0.106	-20.76	-0.143	-13.85	-0.202	-17.89	-0.058	-5.39
B. Expected number of children											
12-15	0.032	0.000	0.29	-0.011	-16.30	-0.012	-35.37	-0.015	-26.01	-0.006	-5.89
16-20	0.360	0.010	1.52	-0.111	-23.69	-0.135	-19.49	-0.170	-17.36	-0.047	-5.59
21-25	1.080	0.065	3.88	-0.296	-27.07	-0.356	-16.02	-0.442	-16.96	-0.073	-3.30
26-30	1.778	0.168	6.16	-0.506	-29.90	-0.569	-17.03	-0.684	-17.21	-0.029	-0.76
31-35	2.313	0.288	7.73	-0.664	-27.91	-0.719	-17.06	-0.849	-15.84	0.072	1.39
36-40	2.678	0.369	8.06	-0.767	-26.65	-0.810	-16.76	-0.948	-14.51	0.168	2.63

Note: 1. Simulations based on estimation results of Table 4.2.
2. References: African, cohort 1960-1964, some secondary school, KwaZulu-Natal.

Source: Own computations based on GHS 2002.

With women with less education than the reference case, the number of births is larger. The results show that primary school educated women aged 36-40 would be expected to have

3.1 births whereas women who complete high school are expected to have 1.9 births. These results of the effects from education are in agreement with Lam and Anderson (2002) who show that even if educational increase from primary school to some secondary school does not increase labour force participation, it decreases the number of births. They interpret this result as education increasing both home productivity and market productivity and for lower educational increases the effects on home productivity are larger than the effects on market productivity. Thus the quantity-quality trade-off starts while women with some education invest in the quality of their children. The conclusions of Table 4.3 are that there are substantial educational effects on both the proportion childless and the completed fertility rate keeping other variables constant.

In Table 4.4, we turn to the question whether educational differences between population groups explain the differences in fertility behaviour. In Panel I of Table 4.4, we use a model without controlling for education in order to contrast the differences in fertility behaviour observed between population groups when education differs as shown above in Figure 4.2 to the differences in fertility behaviour that would result if there were no educational differences between population groups as shown in Panel II of Table 4.4. The estimation results of the model without controlling for education are not reported in this chapter. They are available upon request. Note that since a different model is estimated, the baseline simulations differ slightly between Panel I (without controlling for education) and Panel II (with controlling for education). The results in Panel II are obtained from the estimated model shown in Table 4.3.

Results of Table 4.4 are that, once controlled for educational attainment, Coloured women have no differences in ultimate childless (Panel A) in comparison to African women but they have fewer children (Panel B). Without controlling for education these differences are virtually the same (Panels C and D). Comparing White women to African women shows that if White women had the educational distribution of African women then their fertility behaviour would be less different than it actually is. The negative numbers in Panel A and B are smaller in absolute terms than the negative numbers in Panels C and D. However, there would be differences which mean that in creating educational attainment of African women to the levels of the White women would not wipe out the differences in fertility patterns although the differences would be smaller. Thus the expected numbers of children are 2.07 for White women instead of 1.68 compared to 2.67 for African women and childlessness of 16.3% instead of 27.5% if White women had no higher education than African women. This is a decrease of the difference in ultimate childlessness of 60% and a decrease in the total number of children of 38%[1] if educational attainment would be the same for African and White women.

[1] 100*(-0.976-(-0.605))/0.976)

Table 4.4: Population group effect with and without controlling for education on fertility outcomes

Reference woman		Differences from the reference					
	African	Coloured		Indian		White	
Age group		Diff.	z-value	Diff.	z-value	Diff.	z-value
I. Controlling for education							
A. Probability of having at least one child							
12-15	0.030	0.001	0.98	-0.004	-4.89	-0.006	-7.83
16-20	0.290	0.006	0.90	-0.034	-5.35	-0.044	-8.07
21-25	0.668	0.009	0.90	-0.056	-5.07	-0.072	-8.80
26-30	0.830	0.009	0.99	-0.056	-4.03	-0.076	-7.52
31-35	0.884	0.007	0.84	-0.052	-3.71	-0.072	-7.83
36-40	0.901	0.006	0.78	-0.046	-3.70	-0.064	-7.01
B. Expected number of children							
12-15	0.032	0.001	0.93	-0.004	-3.99	-0.005	-6.44
16-20	0.360	0.005	0.63	-0.032	-3.01	-0.040	-4.98
21-25	1.080	-0.001	-0.05	-0.081	-3.11	-0.105	-6.04
26-30	1.778	-0.051	-1.90	-0.200	-4.95	-0.254	-9.24
31-35	2.313	-0.123	-3.37	-0.359	-6.83	-0.440	-12.14
36-40	2.678	-0.188	-4.14	-0.511	-8.49	-0.605	-14.31
II. Without controlling for education							
C. Probability of having at least one child							
12-15	0.026	0.002	2.23	-0.006	-5.38	-0.008	-10.60
16-20	0.269	0.010	1.39	-0.057	-6.16	-0.089	-20.61
21-25	0.632	0.014	1.29	-0.093	-5.84	-0.161	-16.26
26-30	0.795	0.013	1.35	-0.101	-6.69	-0.168	-14.79
31-35	0.854	0.011	1.37	-0.092	-6.24	-0.158	-14.15
36-40	0.873	0.009	1.29	-0.084	-6.21	-0.148	-12.92
D. Expected number of children							
12-15	0.028	0.002	2.13	-0.006	-4.54	-0.008	-9.30
16-20	0.335	0.012	1.27	-0.067	-5.28	-0.110	-16.84
21-25	1.025	0.012	0.55	-0.177	-5.12	-0.305	-17.35
26-30	1.714	-0.031	-0.87	-0.352	-7.49	-0.540	-20.96
31-35	2.260	-0.101	-2.20	-0.543	-9.95	-0.770	-24.68
36-40	2.651	-0.176	-3.20	-0.723	-12.34	-0.976	-27.43

Note: 1. Simulations based on estimation results of Table 4.2.
2. References: African, cohort 1960-1964, some secondary school, KwaZulu-Natal.

Source: Own computations based on GHS 2002.

The simulation results in Table 4.5 show birth cohort effects in fertility for the reference woman as described above. Table 4.5 shows that there are some significant cohort effects in the expected number of births. The table shows that teenage births are less common among the younger cohorts and considerably so for the cohort born in 1980-1984 with this cohort having a 17% probability of having a child at age 16-20. This probability is almost half in

comparison to the cohort born in 1960-1964 (29%). Given the importance of teenage births for subsequent economic development of the woman (see chapter 5 of this dissertation), our results showing a definite decreasing rate of teenage fertility in younger cohorts compared to older cohorts is a comforting result. Note as well that increasing education also accounts for postponement of births, as shown in Table 4.3

There is considerable regional variation in age at first birth and the expected number of births as presented in Table 4.6. Poor or rural regions have higher hazard rates of births, especially the Eastern Cape presents a higher probability of subsequent births and women from Limpopo are more likely to have their births earlier compared to those from KwaZulu-Natal. Richer or highly urbanized regions such as Gauteng and the Western Cape have low birth hazards. Age at first birth is lowest in Limpopo with women in the age group 36-40 expected to have 3.1 children and those in Gauteng having the smallest completed fertility with an expected number of birth of only 2.3 children.

Table 4.5: Cohort effect on fertility outcomes

Cohort 60-64		Cohort 50-54		Cohort 55-59		Cohort 65-69		Cohort 70-74		Cohort 75-79		Cohort 80-84	
Age group		Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value
A. Probability of having at least one child													
12-15	0.030	-0.006	-6.48	-0.002	-1.42	0.001	1.39	-0.003	-5.58	-0.007	-9.07	-0.014	-23.81
16-20	0.290	-0.046	-6.08	-0.011	-1.66	0.007	1.40	-0.023	-4.95	-0.053	-6.77	-0.124	-20.76
21-25	0.668	-0.075	-6.67	-0.018	-1.59	0.011	1.40	-0.037	-4.82	-0.085	-7.64	-0.014	-23.81
26-30	0.830	-0.080	-6.12	-0.015	-1.51	0.012	1.52	-0.033	-4.28				
31-35	0.884	-0.075	-6.63	-0.013	-1.65	0.008	1.32						
36-40	0.901	-0.067	-6.10	-0.013	-1.73								
B. Expected number of children													
12-15	0.032	-0.006	-6.25	-0.002	-1.58	0.001	1.37	-0.004	-5.92	-0.008	-8.72	-0.015	-26.38
16-20	0.360	-0.057	-5.51	-0.016	-1.75	0.001	0.18	-0.042	-7.22	-0.092	-9.71	-0.186	-29.03
21-25	1.080	-0.116	-4.61	-0.032	-1.45	-0.014	-0.94	-0.149	-10.02	-0.314	-16.97		
26-30	1.778	-0.143	-3.56	-0.033	-0.98	-0.067	-3.20	-0.309	-12.92				
31-35	2.313	-0.136	-2.55	-0.025	-0.58	-0.127	-4.61						
36-40	2.678	-0.116	-1.90	-0.011	-0.23								

Note: 1. Simulations based on estimation results of Table 4.2;
2. References: African, cohort 1960-1964, some secondary school, KwaZulu-Natal.

Source: Own computation based on GHS 2002.

Table 4.6: Regional effect on fertility outcomes

	KwaZulu-	Western Cape		Eastern Cape		Northern Cape		Free State		North West		Gauteng		Mpumalanga		Limpopo	
Age group	Natal	Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value	Diff.	z-value
A. Probability of having at least one child																	
12-15	0.030	0.000	0.24	-0.001	-0.56	0.000	0.07	0.002	3.26	0.003	6.31	-0.002	-2.19	0.004	7.59	0.009	6.44
16-20	0.290	0.001	0.13	-0.005	-0.63	0.000	-0.01	0.015	1.80	0.039	4.00	-0.016	-2.47	0.049	5.75	0.092	12.13
21-25	0.668	0.001	0.13	-0.007	-0.61	0.000	-0.01	0.022	2.10	0.050	4.80	-0.025	-2.40	0.061	5.93	0.111	13.30
26-30	0.830	0.002	0.22	-0.006	-0.55	0.001	0.06	0.021	2.35	0.044	5.75	-0.022	-2.20	0.052	7.34	0.087	12.80
31-35	0.884	0.001	0.11	-0.006	-0.66	0.000	-0.02	0.017	2.19	0.034	6.61	-0.018	-2.33	0.039	8.80	0.065	10.48
36-40	0.901	0.001	0.07	-0.006	-0.71	0.000	-0.03	0.015	2.27	0.030	7.08	-0.017	-2.45	0.034	10.22	0.056	9.80
B. Expected number of children																	
12-15	0.032	0.000	0.17	-0.001	-0.64	0.000	0.01	0.002	3.18	0.003	6.31	-0.003	-2.38	0.004	7.59	0.009	6.49
16-20	0.360	0.002	0.25	-0.002	-0.20	-0.003	-0.24	0.020	1.77	0.049	3.93	-0.027	-3.21	0.063	5.75	0.128	12.25
21-25	1.080	0.003	0.13	0.014	0.58	-0.020	-0.64	0.026	1.14	0.079	3.16	-0.083	-4.19	0.123	4.96	0.283	12.66
26-30	1.778	-0.028	-0.80	0.050	1.34	-0.077	-1.63	-0.028	-0.87	0.035	1.01	-0.184	-5.93	0.153	3.91	0.384	11.71
31-35	2.313	-0.091	-1.95	0.089	1.85	-0.154	-2.57	-0.115	-2.77	-0.049	-1.12	-0.300	-7.77	0.161	3.03	0.438	9.42
36-40	2.678	-0.155	-2.73	0.109	1.96	-0.220	-3.10	-0.199	-4.35	-0.135	-2.80	-0.396	-8.91	0.153	2.63	0.439	8.01

Note: 1. Simulations based on estimation results of Table 4.2;
2. References: African, cohort 1960-1964, some secondary school, KwaZulu-Natal.

Source: Own computation based on GHS 2002.

The effect of child death on fertility treating mortality as exogenous in our study is presented in Table 4.7. We find that there is a tendency to replace the death of a child by having another child. We observe a remarkable increase in the expected number of births in response to the death of the first child. Indeed among women aged 21-25 who experience the death of their first born, the expected number of births is higher by 0.284. Thus, women in this age group are expected to have 1.3 births. At the end of the fecund life at age 36-40, if the first child dies, it has been replaced by 0.88. This is close to 1 which means that there is nearly replacement of a first child's death. Whenever the second child or third child dies, the total family size does not increase by more than 0.50 and 0.21 respectively so on average such deaths of later children are far from replaced and this may have to do with age related biological constraints.

Table 4.7: Fertility outcomes given a child dies

Reference woman		Differences from the reference					
	No child dies	1st child dies		2nd child dies		3rd child dies	
Age group		Diff.	z-value	Diff.	z-value	Diff.	z-value
Expected number of births							
12-15	0.028	0.002	5.58	0.000		0.000	
16-20	0.335	0.064	9.26	0.004	3.13	0.000	3.47
21-25	1.025	0.284	12.52	0.067	6.28	0.009	4.40
26-30	1.714	0.544	14.71	0.212	7.22	0.053	6.04
31-35	2.260	0.761	14.32	0.375	7.08	0.134	5.22
36-40	2.651	0.882	13.17	0.497	7.20	0.207	4.83

Note: 1. Simulations based on estimation results of Table 4.2;
2. References: African, cohort 1960-1964, some secondary school, KwaZulu-Natal.

Source: Own computations based on GHS 2002.

Benefo and Schultz (1996) study the relationship between child mortality and fertility using data from the Living Standards Measurements Surveys 1985-1989 in Côte d'Ivoire and Ghana. They instrument child mortality with access to safe water and health care facilities and do not find significant effects of child mortality on fertility. But when they treat child mortality exogenously as we do in this paper, the effects become significant and the replacement rate for child morality is estimated as 0.17 for the Côte d'Ivoire and 0.08 for Ghana.

4.7 Conclusions

In this chapter, we estimate a Cox's proportional hazard rate model explaining the timing of births and perform simulations to study the effects of a woman's education and population

group on the timing of maternity and the completed number of children. In addition we study regional and birth cohort effects.

The main empirical results are the following. White women are more likely to postpone first birth and have fewer children than African women. The higher the education of a woman the later she schedules births and the fewer children she has. The expected number of births at age 36-40, our proximate age for completed fertility, for Africans is 2.7 while White women are expected to have 2.1 children (ceteris paribus). Our simulations indicate that without controlling for educational differences between African and White women this difference in completed fertility between Africans and Whites increases by about 50%. Furthermore we find that African women have more teenage births. But the youngest cohort of women born 1980-1984 have almost halved their probability of having a teenage birth in comparison to the cohort born 1960-1964. We also examine the effect of child mortality on fertility behaviour and find that women replace very quickly the dead child but responses are much faster if the death occurred to the first child.

South Africa's education policy aimed at increasing levels of education for all women will have fertility responses and this chapter shows that this in particular may result in lower rates of teenage motherhood, a postponement of maternity and lower completed fertility. These results are in line with the quantity-quality trade-off in fertility decisions (see, e.g., Becker, 1981). The reforms of educational policies during the post apartheid era of equal access to educational institutions to all citizens may therefore yield long run economic benefits as it not only improves the quality of life of women and their families but fewer children also make it possible to invest relatively more in the education of the next generation.

Appendix

Table A4.1: Means and standard variation of variables

Variable	Mean	Std Dev
African	0.77	0.42
Coloured	0.12	0.32
Indian	0.03	0.16
White	0.08	0.27
Born in 1950-1954	0.05	0.22
Born in 1955-1959	0.10	0.29
Born in 1960-1964	0.13	0.34
Born in 1965-1969	0.13	0.34
Born in 1970-1974	0.15	0.36
Born in 1975-1979	0.16	0.36
Born in 1980-1984	0.20	0.40
No schooling	0.06	0.24
Primary	0.21	0.41
Some secondary	0.43	0.50
High school	0.21	0.40
Diploma	0.06	0.23
Degree	0.03	0.16
Western Cape	0.11	0.31
Eastern Cape	0.13	0.34
Northern Cape	0.05	0.21
Free State	0.08	0.27
KwaZulu-Natal	0.17	0.38
North West	0.10	0.30
Gauteng	0.15	0.35
Mpumalanga	0.09	0.29
Limpopo	0.12	0.33
Number of children	1.59	1.77
Number of dead children	0.03	0.14
Age of woman at first birth	19.9	4.45
Woman had teenage birth	0.35	0.48
Number of observations	27,367	

Note: If we take mother of at least one child who are aged 20-40 in 2002 (12,260 women), the education distribution is similar to when using the census data-

	Mean	Std. Dev
No school	0.05	0.22
Primary	0.14	0.34
Some secondary	0.49	0.50
High school	0.23	0.42
Diploma	0.06	0.24
Degree	0.03	0.16

Source: Own computations based on GHS 2002

Chapter 5

Teenage Motherhood and Long-Run Outcomes in South Africa

5.1 Introduction

Teenage childbearing is generally considered a poor life choice since responsibilities of early childbearing may have long lasting effects on the socio-economic well being of the mothers and their children. The most commonly cited outcomes for teenage mothers are interrupted education, reduced earning potential, reduced career prospects and poor marital outcomes. In particular many studies in the United States and United Kingdom have observed that schooling of teenage mothers is less than the schooling of similar women, who had their birth later or have had no birth up to the interview time. For example Ermisch and Pevalin (2005), studying the British cohort of women born in 1970, find that having had a teenage birth causes a woman to fare worse in the marriage market, greatly increasing her chances of partnering with poorly educated and unemployment prone men. Using the US National Longitudinal Survey of Youth (NLSY) data, Hotz, McElroy and Sanders (2005) find negative and significant effects of a teenage birth on having a high school diploma by age 28, and being a single mother at age 28. Also, teenage mothers have fewer hours of work and lower annual earnings at age 28 but they also show that causal effects are likely to be much smaller.

Based on Gustafsson and Worku, 2007. This chapter has benefited from comments of KAFEE lunch seminar participants the School of Economics, University of Amsterdam and AIAS lunch seminar participants, University of Amsterdam.

These results for the United States reproduce many earlier studies including Moore and Waite (1977), Card (1981), Mott and Marsiglio (1985) and Upchurch and McCarthy (1999).

The question is to what extent we do observe negative outcomes because this woman has grown up in a family that has negative outcomes in general and also if there are no teenage births. This reason for finding negative outcomes of teenage births is the selection effect. Two methods have been used to disentangle the selection effect from the causal effect: one is the sisters' comparison (Gerominus and Korenman, 1992; Holmlund, 2005) and the other is using a quasi-experiment as an instrument (Hotz et al, 2005; Ermisch and Pevalin, 2005). All studies that have used sisters comparisons and quasi-experiments to control for the selection effect find much smaller negative effects from teenage births and adults outcomes.

Holmlund (2005) uses Swedish register data and is able to extract a sample of teenage mothers and their sisters who are not teenage mothers[1]. Her outcome variables are years of education completed in 2002 for women born 1974 to 1977. In addition to being able to get rid of the family selection effect by studying sister differences, she has information on the pre-pregnancy school grading at age 16 which makes it possible to control for within family heterogeneity. Interestingly, she finds that both the teenage mothers and their sisters have less education than a control group of women of the same cohort who have no teenage births and have no sisters with teenage births. However, one of Holmlund's most surprising results is that there is an inter-sibling difference in pre-pregnancy school results to the favour of non-teenage sisters. Holmlund concludes that when controlling for pre-motherhood school performance the sibling approach is not more informative than a traditional cross-section.

The quasi-experiment used by Hotz et al (2005) is miscarriages, so that the comparison of teenage mothers is to women who had teenage pregnancies that ended in miscarriages. They conclude on the basis of their study of the NLSY that in the United States the adverse outcomes are much smaller and shorter lived when using this natural experiment than has been found in most previous studies.

Ermisch and Pevalin (2005) use information on pregnancies, miscarriages and abortions arguing that while teenage pregnancy is likely to be an unplanned event, the decision to actually give birth is a choice. At age 30, teenage mothers in Britain are more likely to form partnership with low earning unemployment prone men. The instrument variable estimators of teenage motherhood using miscarriages and abortions as instruments are not very different from the estimator obtained without instrumental variables techniques.

[1] Statistics Sweden has created a multigenerational register that contains connections between parents and children via biology and adoption. This register includes all Swedes who were born in 1932 or later and registered as living in Sweden any time from 1961 onwards. Because all Swedes have a personal identifier since 1947, the data of the multigenerational register can be merged to other registers of Statistics Sweden (Björklund, 2006). For example, Holmlund (2005) uses the multigenerational register; the censuses 1975, 1980, 1985 and 1990; the education register and the school registers on data collected from schools, on grade received at age 16, when leaving compulsory school. Researchers are then allowed to buy the custom made data set from which the personal identifiers are deleted but new identifiers linking the data sets are introduced.

Because teenage motherhood and completing high school education have been found to be negatively correlated although the causal direction is not clear, estimating these two events as simultaneously determined is a solution. Ribar (1994) estimates a bivariate probit on the joint probability of having a teenage birth and completing high school for US women also using the NLSY. He uses availability of obstetricians and gynecologists by region, woman's age at menarche and the regional abortion rate as instruments for teenage pregnancy. In this chapter, we study the causal impact of teenage motherhood on high school completion, using regional variation in health care facilities using the General Household Survey 2002 with complete retrospective fertility history.

This chapter is organised as follows. The second section describes the data and variables used. The third section presents descriptive statistics on teenage motherhood in South Africa. Section 5.4 presents the econometric approach used. Section 5.5 discusses the results and section 5.6 concludes.

5.2 Data and samples

The General Household Survey (GHS) is a household based survey conducted by Statistics South Africa since 2000 around July each year and was preceded by the October Household Survey for the years 1995 to 1999. We are using the General Household Survey of 2002 (see chapter 4 of this dissertation). Information is collected on everyone currently living in the household and there is full retrospective information about fertility for women aged 50 or younger in 2002 even if the child doesn't live in the household or has died (Statistics South Africa, 2003). This makes it possible to study long-run outcomes at age 40 and short-run outcomes at age 24 in our definitions.

There are many outcomes in 2002 available in our data including a measure of happiness, and wealth. The wealth variable is an index that runs from minimum 0 to maximum 1. We constructed this variable as an index by combining the main type of material used to construct the roof and walls of the house in which the woman lives in 2002 with the condition of the walls and roofs, the number of rooms and ownership status of the house. Highest scores are allocated to the main materials used to construct the roof and walls of the house. The details of the construction of this variable are shown in appendix B5.1. In addition, we include whether the woman has ever been employed, her employment status in 2002, her occupation, whether she is married in 2002 and if so her husband's occupation. We also use complementary information on abortion rates, the numbers of nurses and doctors by region and per 1,000,000 inhabitants in 2002 and the distance to the nearest clinic measured in minutes that we use as identifying instruments. Further, we have information on contraceptive use by population groups, age, education and urban/rural in 1998 from the South African Demographic and Health Survey. We use the data to impute values on the availability of contraceptives to a woman. These variables are created from Table A5.2 giving the individual

woman a propensity that is formed by the group she belongs[2]. We have information about HIV infection rates by the nine regions from the 2002 Human Science Research Council Survey/Nelson Mandela Survey data sets[3].

We construct four different samples: 1) "all women", 2) "all mothers" 3) "educated women" and 4) "young women" samples and compare outcomes in 2002 for teenage mothers in each of these samples. The first sample includes all women aged 18 to 50 in 2002 and the second sample includes all mothers aged 18 to 50. These two samples make up 24,973 women and 17,576 mothers. The third sample is more restricted and includes all women aged 18 to 50 who have at least completed high school education. This sample includes 8,039 women. The last sample includes women aged 18 to 24 in 2002 and contains 7,288 women. The first sample compares teenage mothers to all other women, whether they are mothers or not. The second sample compares teenage mothers to other mothers who have had their children later. Education has been shown to increase life chances in many respects and we therefore study all women who have completed at least a high school education. The reason for studying young women aged 18-24 in 2002 separately is that those women who are teenage mothers have recently experienced this event. Using the "young women" sample, we can include some additional information for recent years such as the prevalence of contraceptive use, the HIV prevalence rates, the number of abortions, the number of doctors and the number of nurses by region to carry out further analyses.

Means and standard deviations for the four samples are presented in appendix Table A5.1. The proportion of teenage mothers is 44% (Table A5.1) among all mothers. Among all first birth to African women, the proportion of teenage mothers is 47% (see chapter 4 of this dissertation).

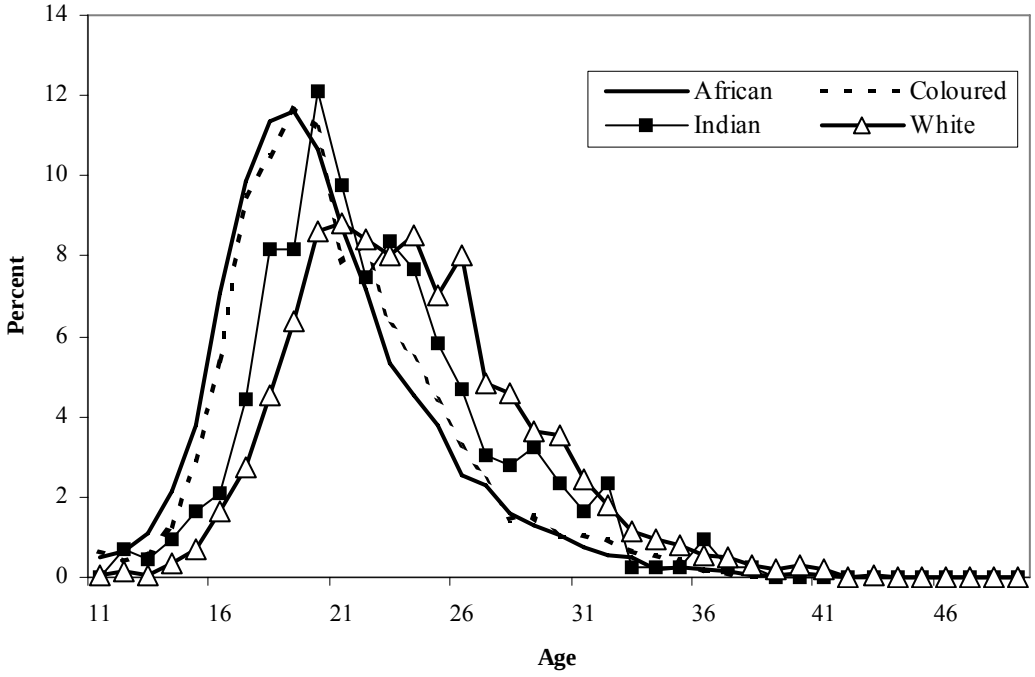
[2] The Depo-Provera is a long-acting progestin form of birth control manufactured by Pfizer. It is injected once every three or six months and its estimated effectiveness in preventing pregnancy is 99%. Depo-Provera has long been controversial because of its health risks. It can cause infertility, lack of bone density, increase in body weight, excessive bleeding or no bleeding and it does not protect against the transmission of HIV. We used the full appendix Table A5.2 to impute a value on the probability of using a type of contraceptive by population group (4); age group (8); urban/rural (2) and education (4). This means that the probability of each of the four contraceptive uses can have 4x8x2x4=256 different values depending on which group the woman belongs to.

[3] South Africa has a very high rate of HIV infected people estimated to be 11.4 % of the population in 2002 (Shisana and Simbayi 2002; Shisana et al, 2005). There is a recent discussion about the negative effects of HIV on fertility (United Nations, 2002; Zaba and Gregson, 1998; (Allen et al 1993; Batter et al, 1994; Carpenter et al 1997). The negative effects of HIV on fertility occur through miscarriages, spontaneous abortions and stillbirths (Gray et al, 1997). The HIV prevalence is however only available for the nine provinces (see Table A5.3).

5.3 Descriptive statistics on teenage fertility

In South Africa, people self-report themselves as belonging to one of the four population groups: African (77%), Coloureds (12%), Indian (3%) or White (8%) as shown in the sample of women aged 18-50 in 2002 (see appendix Table A5.1). Figure 5.1 shows the pattern of first births according to the age of the mother by population group. African women and Coloured women are clearly younger at having their first birth than Indian and White women. The peak age at having first birth is at age 19 for African and Coloured women. Women who were 50 years old in 2002 have been 11 years old as early as in 1963. This means that Figure 5.1 is an average across a time period ranging from 1963 to 2002.

Figure 5.1: First birth by mother's age and population group



Source: Own computations based on the GHS 2002, including all women aged 50 or less in 2002

To give a picture of recent teenage fertility, we use the births that took place in 2001 to compute the number of births per thousand women by age group and present them in Table 5.1. The African and Coloured South African women have 55 and 82 births per thousand women in the age group 15-19. In comparison, Britain with more teenage births than any other Western European country has 29 births per thousand women aged 15-19. African

South African women aged 15-19 have more than twice as many births as British women aged 15-19. Indian and White South African women have low numbers of teenage mothers, closer to the Swedish numbers. There is a concern in South Africa that teenage childbearing might be rising[4]. However chapter 4 of this dissertation shows that teenage fertility of the cohort of women born 1980-1984 is almost half of that of women born in 1960-1964. Many

Table 5.1: Births per thousand women in 2001 by age group

ASFR	Britain	Sweden	S.A: African	S.A: Coloured	S.A: Indian	S.A: White
<15	0	0	5	5	0	0
15-19	24	5	55	82	8	3
20-24	69	41	102	117	83	31
25-29	92	100	101	127	136	96
30-34	88	107	83	100	44	78
35-39	42	51	49	40	9	19
40-44	7	10	19	13	11	3
45-49	0	1	7	3	0	0
Total	323	314	422	487	291	229
Number of births	588,819	95,815	1,497	244	30	73
Number of women (thous)	19, 622	2,040	25,103	3,621	780	2,326
TFR	1.61	1.57	2.11	2.4	1.5	1.15

Notes: 1. Estimated TFR published by Statistics Sweden for 2001 are: 1.57;
2. Estimated TFR published by UK National Statistics Office for 2001 are 1.63;
3. Estimated TFR published by Statistics South Africa for 2001; for South African Africans are: 3.0, for Coloureds: 2.4; for Indians: 2.0 and for Whites are 1.7;
4. ASFR: Age Specific Fertility Rates are calculated as the number of births in a year to mothers in five-year age groups per women of the same age group.

Source: Own computation based on the General Household Survey 2002 (South Africa); Statistics South Africa: Mid-year population estimates 2004. Statistics Sweden: Live birth in Sweden by age of the mother and mid-year populations estimates (Sweden); Office of the National Statistics: Maternities, live births and stillbirths by age of mother and occurrence within/outside marriage and mid-year population estimates 2000-2002 (Britain).

observers are convinced that the child support grant introduced by the government in 1997 is tempting teenagers to get pregnant[5]. This type of incentive has been extensively discussed by

[4] The public broadcaster (SABC) aired in its weekly Special Assignment Program on July 25 2006, a documentary entitled: Imali Ye Qolo –Rent A Womb. The program discusses the rise in teenage pregnancies and the community members around the country beliefs that the reason for this alarming trend is the child grant.

[5] The child support grant was introduced in 1997 by the government to alleviate poverty. The grant is means-tested and is paid via the primary caregiver of the child, to all children who qualify. It amounts to R170 per

American scholars whereby researchers have tried to establish causal links between the size of the monthly AFDC benefits and the decision to give birth (Ellwood and Bane, 1985; Lundberg and Plotnick, 1990; Moffitt, 1992; Klawitter, Plotnick and Edwards, 2000). As a result of these debates, benefit policies have been changed in several of the 50 states in the US to stimulate work rather than spawn benefit dependence among women with dependent children. These changes have been incorporating some aspects of Earned Income Tax Benefits (see e.g. Ehrenberg and Smith, 2006).

In Table 5.2 number of births per thousand woman aged 19 or younger (teenage fertility) and the total fertility rates are presented for selected countries. Teenage childbearing in South Africa is similar to the United States, Turkey and Brazil of around 45 per thousand teenage women having birth as indicated in Table 5.2. In comparison, countries with less than 10 per thousand include Denmark, Italy, Spain and Sweden. Some African countries included in Table 5.2 have more than a 100 teenage births per thousand teenagers namely Kenya, Nigeria and Zimbabwe. In those countries, total fertility rates are also well above replacement rates. The US, Australia and Canada have 2-digits level rates, although in the latter the total fertility rates remain close or below the replacement levels. Among European countries, the United Kingdom stands out with 29 births per thousand teenage women.

5.4 Econometric approaches

The cross sectional data from GHS 2002 allow us to analyse correlations between having had a teenage birth in the past and various outcomes in 2002. We estimate regressions of the following type:

$$Y_i = \alpha_0 + \alpha_1 T_i + \alpha_2 X'_{2i} + \varepsilon_i \tag{5.1}$$

where Y_i is an outcome variable of a woman *i* in 2002; T_i is a dummy variable which equals 1 if the woman had a teenage birth in the past and 0 otherwise; X'_{2i} is a matrix representing other control variables X_2 for woman *i* affecting outcomes in 2002. These are primarily the birth cohort of the woman and her population group; α_0, α_1 and the vector of α_2 are parameters to be estimated. If the true model instead is:

$$Y_{ij} = \beta_0 + \beta_1 T_{ij} + \beta_2 X'_{ij} + f_j + U_{ij} \tag{5.2}$$

---

month as of 1 April 2004, is currently available for children under the age of 14 years who live in households with an income of below R800 per month, or R1,100 per month if the child and his or her so-called 'primary care-giver' either live in a rural area or in an informal settlement.

Table 5.2: Teenage fertility and total fertility rates in 2002 for selected countries

Country	Teenage fertility	Total fertility rates
Australia	18	1.75
Brazil	44	2.30
Botswana	60	3.20
Canada	22	1.52
Denmark	7	1.72
France	11	1.89
Germany	13	1.31
Italy	7	1.26
Kenya	113	5.00
Mexico	51	2.40
Netherlands	8	1.73
New Zealand	14	1.90
Nigeria	124	5.80
Norway	10	1.75
Poland	15	1.24
Portugal	20	1.47
South Africa	46	2.80
Spain	9	1.25
Sweden	7	1.65
Turkey	49	2.46
United Kingdom	29	1.64
United States	43	2.01
Zimbabwe	104	3.60

Note: Teenage fertility France and Germany for 2001; Spain and Portugal for 2000; Turkey for 1998.

Source: Teenage fertility and total fertility rates from Society at a Glance: OECD Social Indicators, 2005, http://www.oecd.org/dataoecd/34/13/34542721.xls; US Bureau of Census; ILO:http//laborsta.ilo.org/

where Y_{ij} is the outcome of individual *i* in family *j*. *S*isters data allows the researcher by differencing over siblings to get rid of the unobserved family component f_j which our data does not allow. This means that our estimates will also include the selection effect f_j. Our analysis below therefore includes the potential effect of belonging to a family prone to adverse outcomes, the selection effect and the proper causal effect of teenage motherhood on outcomes.

In order to be able to compare outcomes at a given age we follow King, Tomz and Wittenberg (2000) to simulate short-term outcomes at age 24 in 2002 and long-term outcomes at age 40 in 2002 for African women, who had a teenage birth in comparison to those who did not for the different samples described earlier. The advantage of this simulation procedure above simple predictions is that it gives us an estimate both of the predicted value and a standard deviation around it. We use a program called CLARIFY developed by King et al (2002) and is a set of macros written in STATA. Once we have estimated the model in equation (5.1) we obtain the estimated coefficients and variance matrix:

$$\hat{\gamma} = \begin{bmatrix} \hat{\alpha}_1 \\ \hat{\alpha}_2 \\ \hat{\alpha}_0 \end{bmatrix} \quad \hat{V} = \begin{bmatrix} V\hat{\alpha}_{11} & V\hat{\alpha}_{12} & V\hat{\alpha}_{1\hat{\alpha}} \\ V\hat{\alpha}_{21} & V\hat{\alpha}_{22} & V\hat{\alpha}_{2\hat{\alpha}} \\ V\hat{\alpha}_0\hat{\alpha}_1 & V\hat{\alpha}_0\hat{\alpha}_2 & V\hat{\alpha}_0 \end{bmatrix} \tag{5.3}$$

where $\hat{\alpha}_2$ is a vector of several coefficients.

To simulate one value of Y_i from equation 5.1, we consider an African woman aged 40 who had a teen birth. We then generate k random draws of the parameters from the multivariate normal distribution $\tilde{\gamma} \sim N(\hat{\gamma}, \hat{V})$ that are stored in k new variables. Thus each draw is a vector of simulated parameters such that:

$$\tilde{\gamma} = \begin{bmatrix} \tilde{\alpha}_{11} \\ \tilde{\alpha}_{21} \\ \tilde{\alpha}_1 \end{bmatrix} \begin{bmatrix} \tilde{\alpha}_{12} \\ \tilde{\alpha}_{22} \\ \tilde{\alpha}_2 \end{bmatrix} \cdots \begin{bmatrix} \tilde{\alpha}_{1k} \\ \tilde{\alpha}_{2k} \\ \tilde{\alpha}_k \end{bmatrix} \tag{5.4}$$

The default number of simulations is 1,000. After simulating the parameters, the program sets values for the explanatory variables and calculates bounds on the values of the explanatory variables. Then one can simulate various quantities of interest such as predicted values, expected values and first differences. Simulated expected values are equivalent to simulated probabilities for all discrete choice models (probit and ordered probit) used in our analysis. In these models, the quantities presented are the *Probability (Y=1)* for the probit model and the *Probability (Y=j) for all j* for the ordered probit model. For the OLS model, the expected value of Y or *(E(Y))* is estimated. We use four different sub-samples in our estimation of (5.1) and simulation exercise.

We estimated univariate probits on the probability of completing high school and being a teenage mother respectively and a two stage least squares (2SLS) model in which the probability of teenage motherhood and the probability of high school completion are simultaneously estimated. This model is equivalent to a maximum likelihood bivariate probit

model and is preferred when both the dependent variable and the endogenous variable are binary (Angrist, 2001 and Wooldridge 2002, p.622). In the first stage of the 2SLS approach we use Ordinary Least Squares (OLS) to estimate the following model of teenage motherhood in terms of observed factors:

$$T_i = \theta \varpi_i + e_i \qquad (5.5)$$

where T_i is 1 if the person had teenage birth and 0 otherwise; ϖ_i is a vector of individual and geographical characteristics; θ is a parameter to be estimated and e_i is the error term. In the second stage of 2SLS, we assume that the teenage motherhood decision is determined by:

$$S_i = \delta_1 Z_i + \delta_2 T_i + u_i \qquad (5.6)$$

where Z_i are the exogenous identifying instruments; δ_1 and δ_2 are parameters to be estimated and u_i is the error term. Consistent estimated are obtained by 2SLS regardless of the underlying error distributions (Angrist, 2001).

The choice of Z_i is very important. We use a number of instruments as suggested by the literature: abortion rates by region, number of doctors per 1,000,000 of the population by region and number of nurses per 1, 000,000 of the population by region. In addition, we use distance to the nearest clinic which is observe from the data s an additional instrument. These variables are most likely to affect childbearing but not educational attainment and thus represent acceptable potential instruments. Appendix Table A5.1 shows the means and standard deviations of these variables and appendix Table A5.3 shows their values across the nine regions. Unfortunately the variations of these variables are only across the nine regions. In this analysis we use the 'young women' sample, women aged 18-24 in 2002 because the instruments are for recent years.

5.5 Results

The coefficient on the dummy variable of having had a teenage birth in the past as estimated according to equation (5.1) above in various analyses is shown in Table 5.3. The first row of Table 5.3 shows that teenage mothers are less likely to have completed high school in comparison to all other women and to all mothers. These two coefficients are about -0.5 for both comparisons. For those women who are young and recently had a teenage birth, the coefficient is still more negative (-0.6). This shows that there are strong negative effects of teenage births on high school completions which are in line with results from previous studies on the United States, Britain and Sweden cited above. The second line of Table 5.3 shows results from having had a teenage birth on the wealth variable. Also this outcome is

significant and negative for teenage mothers in three of the four samples. It is not significant among the group of educated women comparing women who had a teenage birth but also managed to complete high school to women with high school education who did not have a teenage birth. Furthermore, women with teenage birth are less likely to be employed. The employment history, the probability of being married and spouse's occupation are not negative to teenage mothers.

Table 5.3: Outcomes in 2002, estimated coefficient of the dummy variable of having had a teenage birth in the past

Sample	All women		All mothers		Educated women		Young women		
Age	18-50		18-50		18-50		18-24		
	Coeff	z-value	Coeff	z-value	Coeff	z-value	Coeff	z-value	Method
1. Completed high school or higher	-0.516	-25.8	-0.487	-21.6	-	-	-0.615	-15.4	Probit
2. Wealth	-0.017	-7.2	-0.013	-4.9	-0.007	-1.5	-0.026	-5.7	OLS
3. Married/Cohabiting	0.287	15.4	0.032	1.6	0.308	7.8	0.713	17.1	Probit
4. Employed in 2002	0.047	0.3	-0.036	-1.8	-0.025	-0.6	0.175	3.9	Probit
5. Ever worked	0.171	8.8	0.080	3.6	0.111	2.7	0.243	6.2	Probit
6. Woman's occupation	-0.087	-5.1	-0.129	-6.9	-0.097	-2.7	0.112	2.6	Oprobit
7. Spouse's occupation	0.181	11.1	-0.043	-2.4	0.206	5.6	0.636	15.9	Oprobit
8. Satisfaction with life	-0.029	-2.0	-0.027	-1.6	0.037	0.9	-0.019	-0.7	Oprobit

Note: We also controlled for population group and cohorts.

Source: Own computations based on the GHS 2002 data

In Tables 5.4 and 5.5, we show simulated outcomes based on the full analyses underlying Table 5.3. The simulations are performed as described in section 5.4 above. The simulations allow a prediction at a given age and give a standard deviation for the prediction. It would not be appropriate for example to compare wealth between people of different ages because a younger person would be expected to have much less wealth than an older person. For binary variables such as whether the woman completed high school or not, the simulated value gives the probability that a woman of a certain characteristics has completed high school. The main impression in Tables 5.4 and 5.5 is small differences in many of the outcomes between teenage mothers and other mothers. There are however big differences in the proportion who completed high school between teenage mothers and other women whereas 13% of all mothers who had teenage birth have also completed high school, the proportion is 28% if they did not have teenage birth. For young women, the difference is also large, whereas 52% of women who have no teenage birth have completed high school at age 24, this is only true for 29% of the teenage mothers.

The simulated results of wealth at age 40 do not differ between teenage mothers and other women although the coefficient is negative and significant as shown in Table 5.3 above. The

simulated results are 0.70 for teenage mothers and 0.71 for non-teenage mothers respectively. They do however differ between educated women and all mothers with the value of the index decreasing from 0.70 to 0.62. Having completed high school increases the probability of being employed in 2002 which can be seen by comparing the outcomes for the "educated women" sample to the outcome of the "all mothers" sample. There are no differences in being married or cohabiting in 2002, or being employed between mothers who had a teenage birth and mothers who had their children at a later age.

Table 5.4: Simulated outcomes in 2002 at age 40 and 24 for African women

Sample	Predicted at age	If teen birth	If not teen birth	If teen birth	If not teen birth
		A. Completed high school		*B. Wealth*	
Educated women (aged 18-50)	40	-	-	0.70	0.71
		-	-	(0.005)	(0.003)
All mothers (aged 18-50)	40	0.13	0.28	0.62	0.63
		(0.004)	(0.006)	(0.002)	(0.002)
Young women (aged 18-24)	24	0.29	0.52	0.60	0.62
		(0.015)	(0.013)	(0.005)	(0.004)
		C. Married/cohabiting		*D. Employed*	
Educated women (aged 18-50)	40	0.67	0.54	0.64	0.64
		(0.014)	(0.011)	(0.015)	(0.011)
All mothers (aged 18-50)	40	0.57	0.56	0.44	0.46
		(0.007)	(0.006)	(0.007)	(0.006)
Young women (aged 18-24)	24	0.40	0.17	0.24	0.19
		(0.017)	(0.010)	(0.014)	(0.010)

Note: Standard errors in parentheses.

Source: Own computation based on the GHS 2002 data

Table 5.5 shows that the educated women have better jobs, with 30% of them in professional or senior management positions. Among educated women who are married or cohabiting, 23% have professional husbands if they had teenage birth whereas 27% have professional husbands if they did not have teenage birth. Again, the differences are between educated and non-educated women and not between who did or did not have teenage birth within the educated or non-educated groups. In panel C of Table 5.5, we show predicted values for satisfaction with life which we estimated by ordered probits. Whereas other simulated values: wealth, whether employed, woman's occupation and husband's occupation show higher values for educated women than for non-educated women, the differences to the advantage of educated women are very small, with regards to satisfaction with life. Adding 'very satisfied' to 'satisfied' shows among educated women with no teenage birth 46% are

satisfied whereas the corresponding percentage for mothers in general is 41%. But 22% of educated women are 'dissatisfied' or 'very dissatisfied' as compared to 29% of all others.

Our main result from the analyses presented in Tables 5.4 and 5.5 is that teenage mothers are less educated than non-teenage mothers and that educated women have better life chances: higher wealth, more likely to be employed, better occupation and better husband's occupation than women on average. There is a conflict between the desirability of increasing human capital among the population and the high propensity of teenage births in South Africa. We will therefore turn to an analysis of the relationship of completing high school and teenage motherhood.

Table 5.5: Simulated outcomes in 2002 for African women at age 40

Sample	All mothers		Educated women	
Age	18-50		18-50	
	If teen birth	If not teen birth	If teen birth	If not teen birth
A. Woman's occupation				
1. Professional/Senior official	0.06 (0.002)	0.08 (0.003)	0.27 (0.012)	0.30 (0.009)
2. Clerk and service worker	0.10 (0.003)	0.12 (0.003)	0.24 (0.006)	0.25 (0.006)
3. Skilled agric., craft /mach operator	0.04 (0.002)	0.05 (0.002)	0.03 (0.002)	0.03 (0.002)
4. Elementary occupation/Domestic worker	0.20 (0.003)	0.21 (0.003)	0.07 (0.003)	0.07 (0.003)
5. No work	0.59 (0.006)	0.54 (0.006)	0.38 (0.014)	0.35 (0.010)
B. Spouse's occupation if the woman is married or cohabiting				
1. Professional/Manager/Senior official	0.06 (0.003)	0.08 (0.002)	0.23 (0.015)	0.27 (0.011)
2. Clerk and service worker	0.07 (0.003)	0.08 (0.002)	0.13 (0.007)	0.14 (0.006)
3. Skilled agric. or craft /mach. operator	0.25 (0.005)	0.27 (0.003)	0.26 (0.008)	0.26 (0.008)
4. Elementary occupation/Domestic worker	0.13 (0.004)	0.13 (0.002)	0.05 (0.005)	0.05 (0.004)
5. Spouse unemployed	0.23 (0.005)	0.22 (0.002)	0.15 (0.008)	0.14 (0.008)
5. Spouse does not live in household	0.26 (0.007)	0.21 (0.003)	0.17 (0.013)	0.15 (0.009)
C. Satisfaction with life				
1. Very satisfied	0.11 (0.003)	0.12 (0.003)	0.14 (0.008)	0.13 (0.006)
2. Satisfied	0.27 (0.004)	0.27 (0.004)	0.33 (0.006)	0.33 (0.006)
3. Indifferent	0.33 (0.004)	0.33 (0.004)	0.32 (0.006)	0.32 (0.006)
4. Dissatisfied	0.17 (0.004)	0.17 (0.003)	0.13 (0.006)	0.13 (0.005)
5. Very dissatisfied	0.13 (0.004)	0.12 (0.003)	0.08 (0.005)	0.09 (0.004)

Note: Standard errors in parentheses.

Source: Own computation based on the GHS 2002 data

We estimated univariate probits on the probability of completing high school and a 2SLS where high school completion is estimated using fitted vales of the teenage motherhood equation. Because we are using instruments created from characteristics as of 1998, the South African Demographic and Health Survey and use an average of 1997-2000 data (see appendix Tables A5.2 and A5.3), we use the young women sample for analysis. The results are shown in Table 5.6.

From the univariate probits we can see that teenage childbearing has strong negative impacts on completing high school which is in accordance to our results shown above and to results of previous studies on the US, UK and Sweden. Contraceptives availability is shown by our variables propensity of Depo Provera use and propensity of modern contraceptive use which are compared to the probability of using no contraceptives. Contraceptives use to young women has a strong positive effect on high school completion rates and negative effects on teenage childbearing. Particularly, the coefficient for propensity of modern contraceptive use is strongly positively significant in the univariate high school completion probit. We also present linear probability results using OLS for comparison purposes.

The 2SLS model has been suggested in the literature to take account of the endogeneity problem. Our result for the 2SLS model shows that the coefficient for teenage motherhood is negative and significant. This means that even when the endogeneity is taken into account, teenage motherhood has still a significant impact on the high school completion risk. Among the instruments, only the regional abortion rate is not significant and all the rest are significant although they seem to have very weak affects. In particular, the higher the number of nurses the less likely is the occurrence of teenage motherhood and the larger the distance to the nearest clinic the more likely is the occurrence of teenage motherhood. A joint significance test of these instruments shows that they are jointly significant.

Although our test for exogeneity using a Hausman test cannot be rejected at the 5% level of significance, it can be rejected at the10% level of significance[6]. Due to the availability of limited number of variables, we are only able to control for exogenous characteristics like population group, propensity of contraceptive use and HIV prevalence although several other characteristics have been shown to have an influence in previous studies. We therefore have an omitted variables problem and our results would very likely have been improved if we had had access to information on parents' education level, their income and whether the woman comes from an intact family.

[6] We conduct a modified Hausman test in which the residual from the teenage motherhood equation is added as a regressor in the high school completion model.

Table 5.6: Effects of teenage childbearing on high school completion: young sample age 18-24 in 2002

	Teenage motherhood						High school completion					
	Probit		OLS		2SLS		Probit		OLS		2SLS	
	Coef.	z-value	Coef.	t-value	Coef.	t-value	Coef.	z-value	Coef.	t-value	Coef.	t-value
Intercept	-0.488	-5.12	0.314	10.45	0.344	8.33	-1.957	-19.53	-0.146	-4.85	-0.037	-0.51
Coloured	0.087	1.39	0.029	1.42	0.050	2.13	0.671	10.56	0.212	10.58	0.222	10.08
Indian	-0.486	-2.46	-0.123	-2.34	-0.130	-2.46	1.278	7.60	0.477	9.09	0.434	7.11
White	-0.903	-6.92	-0.192	-5.69	-0.175	-5.15	1.879	17.73	0.662	19.74	0.596	11.25
HIV prevalence rate	0.005	0.75	0.002	0.79	0.005	2.18	0.034	5.26	0.010	5.19	0.011	5.10
Propensity of Depo Provera use	-0.002	-0.01	-0.016	-0.32	-0.009	-0.19	1.328	7.86	0.474	9.61	0.468	8.95
Propensity of modern contraceptive use	-0.665	-1.12	-0.115	-0.85	-0.112	-0.83	3.328	5.69	0.840	6.25	0.800	5.55
Urban	-0.285	-7.38	-0.094	-7.73	-0.068	-5.06	0.310	7.98	0.096	7.89	0.063	2.73
Teenage mother							-0.501	-12.43	-0.144	-12.38	-0.492	-2.40
Regional abortion rates					0.058	0.66						
Number of doctors per 1,000,000					0.001	2.01						
Number of nurses per 1,000,000					-0.001	-3.50						
Distance to the nearest clinic					0.001	2.52						
Number of observations	7,288		7,288		7,288		7,288		7,288		7,288	
Log likelihood	-4033.14						-3965.84					
R-squared (%)	2.77*		2.73		3.08		13.05*		15.62		5.31	

Note: 1. Exogeneity test: chi2 (1) =3.23 Prob>chi2=0.0723;
2. Joint significance test of instruments: F (4, 7276) =6.61 Prob>F=0.0000;
3. References: African, No contraceptives;
4. In *, Pseudo R-square are reported.

Source: Own computation based on the GHS 2002 data

5.6 Conclusions

In this study, teenage motherhood in South Africa has been shown to be associated with a decrease in the probability of completing high school. Completing high school is associated with better life chances: higher wealth, higher probability of being employed, a better occupation and a better husband's occupation. In South Africa, teenage birth is not a minority but half of all first births for women aged 18-50 in 2002. Following suggestions in the literature we model teenage motherhood as being endogenous to high school completion. We use four instruments three of which unfortunately vary by the nine regions: the regional abortion rate, the number of doctors and nurses per 1,000,000 inhabitants. The fourth instrument which is the distance to the nearest clinic in 2002 varies for each woman. We carry out the 2SLS on the sample of young women aged 18-24 in 2002 because our supplementary information is for a recent year.

Our finding indicates that teenage motherhood has a strong negative effect on the high school completion when treated as exogenous. When modeling the simultaneity of the two events, there is significant evidence of endogeneity and the effect of teenage motherhood on high school completion decreases. We must conclude that there is statistical evidence of simultaneity between high school completion and teenage motherhood and our instruments do a fairly good job of controlling for endogeneity. Also the strong negative correlation between teenage motherhood and high school completion and the better life chances for educated women suggest that there is a policy implication from our research. Information on contraceptives use and increased access to contraceptives by teenagers, much more effective sex education and increased awareness of the negative consequences of early childbearing to mothers can raise high school completion rates and decrease teenage childbearing. Failing to supply contraceptive education can result in failures to increase high school completion rates. Although this chapter does not address the consequences for the children it is likely that a child born to a more mature woman who is married to the father of the child may have better life chances.

Appendix

Table A5.1: Samples means and standard deviations of variables

Sample	All women	All mothers	Educated women	Young women
Age	18-50	18-50	18-50	18-24
African	0.77	0.77	0.66	0.81
Coloured	0.12	0.13	0.10	0.11
Indian	0.03	0.02	0.05	0.02
White	0.08	0.08	0.20	0.05
Born in 1950-1954	0.06	0.07	0.04	0.00
Born in 1955-1959	0.10	0.14	0.07	0.00
Born in 1960-1964	0.14	0.18	0.12	0.00
Born in 1965-1969	0.14	0.17	0.15	0.00
Born in 1970-1974	0.16	0.19	0.20	0.00
Born in 1975-1979	0.17	0.15	0.23	0.24
Born in 1980-1984	0.22	0.10	0.20	0.76
Western Cape	0.11	0.11	0.12	0.10
Eastern Cape	0.13	0.13	0.10	0.13
Northern Cape	0.05	0.05	0.03	0.04
Free State	0.08	0.08	0.07	0.08
KwaZulu-Natal	0.17	0.17	0.15	0.18
North West	0.10	0.10	0.10	0.10
Gauteng	0.15	0.14	0.22	0.13
Mpumalanga	0.09	0.09	0.09	0.10
Limpopo	0.12	0.13	0.11	0.13
Urban	0.59	0.58	0.75	0.55
Age	31.62 (9.31)	34.28 (8.55)	30.59 (8.30)	20.79 (1.97)
Teen birth	0.31	0.44	0.18	0.26
HIV prevalence rate				11.31 (2.66)
Propensity of no contraceptive use				0.53 (0.18)
Propensity of Depo Provera use				0.45 (0.19)
Propensity of modern contraceptive use				0.06 (0.05)
Number of doctors per 1,000,000				61.97 (47.27)
Number of nurses per 1,000,000				210.14 (79.05)
Regional abortion rate*s*				0.13 (0.12)
Distance to the nearest clinic				25.7 (18.3)
Completed high school	0.32	0.29	1.00	0.32
Wealth	0.64 (0.18)	0.63 (0.18)	0.71 (0.17)	0.63 (0.18)
Married/cohabiting	0.42	0.53	0.41	0.13
Employed	0.37	0.42	0.48	0.14
Ever worked	0.59	0.68	0.64	0.24
Woman's occupation	1.82	1.92	2.50	1.31
Man's occupation	2.43	2.80	2.79	1.43
Satisfaction with life	3.24	3.24	3.46	3.20
Number of observations	24,973	17,576	8,039	7,288

Note: Standard deviation in brackets.

Source: Own computation based on the GHS 2002 data.

Appendix B5.1: Construction of the wealth variable

We constructed the wealth variable using the following variables:

the roof material=0 if it is plastic, cardboard, asbestos or mud;
the roof material=1 if it is a mixture of mud and cement, wattle and daub or thatching;
the roof material=2 if is corrugated iron zinc, or mud or wood;
the roof material=3 it is brick, cement block/concrete, wood and tile.

the wall material=0 if it is plastic, cardboard or asbestos;
the wall material=1 if it is corrugated iron zinc, mud or thatching;
the wall material=2 if it is a mixture of mud and cement, wattle and daub or thatching;
the wall material=3 it is brick, cement block/concrete or wattle and daub.

the roof condition=0 if it is very weak or weak;
the roof condition=1 if it needs minor repairs;
the roof condition=2 if it is good;
the roof condition=3 if it is very good.

the wall condition=0 if it is very weak or weak;
the wall condition=1 if it needs minor repairs;
the wall condition=2 if it is good;
the wall condition=3 if it is very good.

the ownership status=0 if the house is occupied rent free not as part of employment contract of a family member;
the ownership status=1 if the house is rented or occupied rent free as part of employment contract of a family member;
the ownership status=2 if the house is owned but not yet fully paid;
the ownership status=3 if the house is owned and fully paid for.

the number of rooms=0 if the number of rooms is one (excluding bathrooms and toilets); the number of rooms=1 if the number of rooms is 2 to 4;
the number of rooms=2 if the number of rooms is 5 to 6;
the number of rooms=3 if the number of rooms is 7 or more.

Finally the wealth index is computed as:

Wealth= ((roof material x 30) + (wall material x 30) + (roof condition x 15) + (wall condition x 15) + (ownership x 10) + (room x 20))/360.

If the index is close to 1 then the wealth status is high.

Table A5.2: Contraceptive use in 1998

	African				Coloured				Indian				White			
Age	None	Depo	Modern	Tradi-tional	None	Depo	Modern	Tradi-tional	None	Depo	Modern	Tradi-tional	None	Depo	Modern	Tradi-tional
15-19	66.8	26.6	5.9	0.8	78.6	18.8	2.5	0.0	93.7	1.6	4.8	0.0	86.2	2.6	11.2	0.0
20-24	41.9	45.0	12.5	0.6	50.8	39.1	10.1	0.0	60.7	4.9	34.4	0.0	54.1	12.2	33.8	0.0
25-29	41.2	43.6	14.2	1.0	40.7	39.3	20.0	0.0	36.7	2.0	61.2	0.0	33.0	9.7	56.3	1.0
30-34	42.3	37.9	18.6	1.2	37.9	30.8	31.3	0.0	15.9	7.9	73.0	3.2	27.7	2.5	68.9	0.8
35-39	48.1	26.6	24.5	0.8	31.6	25.0	43.0	0.4	28.1	5.3	66.7	0.0	22.6	3.2	74.2	0.0
40-44	56.4	17.5	26.0	0.1	42.9	13.5	42.9	0.6	35.8	0.0	64.2	0.0	20.2	0.9	75.4	3.5
45-49	69.9	6.9	22.9	0.3	50.0	6.4	43.6	0.0	34.0	0.0	66.0	0.0	37.1	1.0	61.9	0.0
Total	51.5	31.8	15.9	0.8	48.5	26.4	25.0	0.1	44.5	3.3	51.7	0.5	39.3	4.1	55.8	0.8
Urban	44.0	35.9	19.6	0.6	48.8	24.5	26.5	0.2	44.2	3.4	51.9	0.5	38.8	4.1	56.1	0.9
Rural	58.3	28.2	12.6	0.9	47.4	32.5	20.1	0.0	62.5	0.0	37.5	0.0	42.7	4.2	53.1	0.0
None	68.9	17.2	12.7	1.3	49.4	21.8	28.7	0.0	80.0	0.0	20.0	0.0				
Low	59.8	24.9	14.6	0.7	47.7	25.8	26.5	0.0	16.7	0.0	83.3	0.0	75.0	0.0	25.0	0.0
Medium	48.7	35.1	15.5	0.7	48.3	28.0	23.6	0.1	44.4	3.3	51.7	0.6	41.8	4.5	53.2	0.4
High	32.4	36.3	30.5	0.8	53.0	9.1	36.4	1.5	53.8	5.1	41.0	0.0	33.5	3.3	61.6	1.7

Notes: 1. The 1998 South African Demographic and Health Survey (SADHS) is a national two-stage stratified household survey and included approximately 12,000 women aged 15-49. It was designed principally to produce reliable estimates of demographic rates (particularly fertility and childhood mortality rates), maternal and child health indicators, and contraceptive knowledge and use for the country as a whole, the urban and the non-urban areas separately, and for the 9 provinces;

2. Contraceptive use rates are calculated for women aged 15 to 49 by education level: none, low, medium and high; population group: African, Coloured, Indian and White; age groups: 15-23, 24-28, 29-33, 34-38,39-43,44-48,49-50; by geography urban, rural. None includes all those with no education, low include all those up to grade 6 (standard 5), medium from grade 7 to 12 and high more than high school education. The overall modern contraceptive prevalence rate is estimated at 61%.

Source: Own computation based on the South African Demographic and Health Survey 1998.

Table A5.3: HIV prevalence rate, abortion rates, the number of doctors and nurses

Province	HIV prevalence rate	Abortion rates	Number of doctors	Number of nurses
Western Cape	0.107	0.13	153.1	309.8
Eastern Cape	0.066	0.07	30.7	180.2
Northern Cape	0.084	0.01	43.0	189.9
Free State	0.149	0.10	56.5	253.9
KwaZulu-Natal	0.117	0.15	54.4	191.8
North West	0.103	0.03	24.6	165.4
Gauteng	0.147	0.41	135.4	353.6
Mpumalanga	0.141	0.06	33.6	128.9
Limpopo	0.098	0.03	14.8	110.4
Total	0.114	0.13	64.7	214.8

Note: The Nelson Mandela/HSRC survey is a representative national household survey which consists of close to 10, 000 households stratified by province and urban/rural. It is the first household based survey designed principally to produce estimates of HIV prevalence and to track, knowledge, attitudes and practices related to HIV. Respondents' specimens of oral transudate and the ELISA test were used to test nearly 8,500 participants in the survey. The overall response rate for the survey is 62.3%.

Source: Human Science Research Council Survey/Nelson Mandela Survey, 2002-Department of Health 1997-2000.

Chapter 6

Summary and Conclusions

6.1 Introduction

In the modern world the family structure has changed. The acceptability of out of wedlock childbearing and divorces has increased the number of single mothers. The increase in the labour force participation of women has contributed in human capital investment incentives by women, which in turn contribute, to postponement of birth, childlessness or to smaller completed fertility. Although the three countries discussed in this dissertation present currently empirical evidence of the lowest low fertility in their history, they have varying fertility patterns due to a mixture of reasons. In the four chapters discussed above we examine marriage markets, union formation, timing of birth and fertility in these countries.

6.2 Marriage markets and fertility

In chapter 2, we examine who marries whom and preferences on the optimal sorting of mates among Swedish and British couples. We also analyse the timing of couple formation and first birth and compare Swedish couples to British couples. The analysis includes couples who have experienced both events. We use the BHPS and the HUS panel data sets for analysis.

A model of timing of union formation and first birth is estimated by distinguishing between different combinations of educational grouping of Swedish and British couples born 1930-1979. We assume that a woman has a plan for investments in human capital as well as a

career plan and thus there is an optimal age at union formation and optimal age at first birth. In a first step, which represents the mating function, a spouse choice equation is estimated based on individual human capital and family of origin characteristics as well as marriage market indicators, using a multinomial logit model.

The results show that there is assortative mating by education where most people form a union with somebody who has a similar education level as themselves. Nine educational categories are created using predicted probabilities of marital sorting given the individual education level and other background variables. In a second step, the rates of union formation and first birth are estimated using Weibull hazard models with individual unobserved heterogeneity, predicted educational categories and other fixed and time varying variables serving as explanatory variables. Women of wealthier social class postpone both union and parenthood. The amount of human capital accumulated, the duration in education and unfavorable labor market conditions reduce the rates of transition into both states. Swedish women form their union later but once the union has been formed, they are quicker to have their first birth. The effect of unobserved individual heterogeneity is only significant in the duration from union to first birth.

In chapter 3, we model women's decisions in the marriage market as an outcome of marital choice among African South African mothers. The motivation for this analysis is the low marriage rates among African South African mothers aged 20-40. We argue that the reason for this is the low sex ratio among African South Africans in the age group 20-40 (91.8) which is lower than the White South Africans' sex ratio (96.4).

Becker's theory predicts that sex ratios have implications for the proportion of women who remain single and this prediction has been analyzed in a number of US studies. In this chapter we test the hypothesis that when the sex ratio declines South African women who have at least one child are more likely to accept less desirable forms of marital status. We order marital status in the following way, from the least attractive, 1) never married, through 2) unmarried cohabitation, and 3) traditional marriage, to the most attractive, 4) civil marriage.

We define marriage markets at the 53 district council levels for each population group separately and use the population census 2001 data to calculate the sex ratios. Mate availability is defined by 1) the number of men, 2) the number of employed men, 3) the number of men who completed higher education and 4) the number of men with sufficient income. The sex ratios show that there is a larger supply of men in urban areas than in so-called tribal areas. Moreover the urban districts have a considerable influx of migrant labourers in general, since most of the mines, large commercial farms and other real or perceived work opportunities are there.

We estimate ordered probit models to establish the determinants of type of marital relationship entered into among South African mothers between the ages of 20 and 40. We control amongst other for age, population group, religion, living in a metropolitan area employment and regional unemployment rates. In a second analysis we add some variables

that may be endogenous to marital choice such as income and education to control for heterogeneity among women.

The results show that African women have a less desirable marital status compared to Whites. Also other things equal, an employed woman with low income is less likely to be in a good marriage than a not employed woman. But an employed woman with high or medium income is more likely to be in a good marriage than a woman who is not employed. Religious affiliation also contributes positively to marriage whereas women who reported having no religion are most likely to remain single. Living in a metropolitan area has a weak negative effect on marriages. The probability of a good marriage is substantially increased in a low unemployment area.

Varying the definition of the sex ratios of marriageable men results in the availability of economically attractive men (men with sufficient income or employed men) contributing highly to the shift to a better marital state. Availability of educated men is also important for a good marriage among Africans whereas the effect is negative among Whites. The estimation results suggest that both the quantity and quality of marriageable men matter in the marital choice of women who have at least one child.

A simulation exercise exposing African women to the White women's marriage market and achievement of educational levels similar to those of Whites increase their probability of marriage by 8%, implying that only 44% of African women are expected to marry even given good marital opportunities and improved levels of education as opposed to 86% married among White women.

Predicting marital outcome for high educated African women only results to close to 60% of women marrying among which close to 50% marrying in civil marriages. Thus high educated African women behave differently. These findings confirm that the racial differences are not solely due to the poor marital prospects of African women. Our results indicate that the conclusion holds even when we control for variables that may be related to marital choice decisions. Perhaps postponing motherhood would increase the chances of the women to be married to the father of their child.

In chapter 4, we fit a multi-spell duration model for all levels of births to identify the role of education and population group in postponement of birth and achieved completed fertility for all women aged 18 to 50 in South Africa using the 2002 General Household Survey. This is because from 1981 to 2005, the total fertility rate in South Africa has been reduced from an estimated level of 4.6 to 2.8 children per woman. The relative differences between population groups however remain large. We analyse to what extent differences in women's education explains the differences between population groups in the timing of births and completed fertility. In the first part of our analysis, we estimate Cox proportional hazard models for each birth. We then carry out Monte Carlo simulations in which year-by-year births are simulated for the woman from age 12 to 40. We arbitrarily set the reference woman to be an African born in 1960-1964, who has some secondary education and lives in KwaZulu-Natal.

Our finding indicates that there are racial differences in the age at first birth. African women give birth to their first child earlier compared to the other population groups and attain relatively higher completed fertility while White women postpone first birth and attain relatively lower completed fertility. White women are also less likely to have a third birth. Total childlessness is estimated to be 10% among African women and 16% among White women.

In line with earlier studies we find that the higher the level of education the later a woman schedules births and a decrease in completed fertility with education. Primary school educated women aged would be expected to have 3.1 births whereas women who completed high school are expected to have 1.9 births. High-order births are more common among low educated women and among women who started childbearing as teenagers. Differences in education between population groups account for a substantive part (up to 40%) of the difference in completed fertility between the population groups. There may be some 'catching up effect' soon after the end of education for those who started childbearing late.

We also observe postponement of births among the younger cohorts. In fact the cohort born 1980-194 has halved the probability of having teenage birth compared to the cohort born 1960-1964. The death of a child shortens the interval until the next birth because women want to replace rapidly the lost child to achieve the optimal number of living children planned for.

In chapter 5, we study whether South African women who had a teenage birth in the past are observed to have negative outcomes in 2002. We use the same data set as in the previous chapter. We run separate models on different samples: the 'all women', 'all mothers' and 'educated women' samples for women aged 18 to 50 and the 'young women' for women aged 18 to 24. The reasons for studying these different samples are that the 'all women' sample includes childless women as well as mothers and one can argue that the right comparison is between women who were teenage mothers and other mothers who had their child at a later age. The separate 'educated women' sample is motivated by the idea that education may result in different behaviour. The 'young women' sample is studied separately because they experienced the risk of teenage pregnancy rather recently in a South Africa which has the institutional arrangements currently in place.

We examine outcomes such as high school completion, wealth status, marital status and labour market conditions in 2002. Our main findings are that teenage childbearing is negatively correlated with completing high school, but most other outcome measures do not show the negative effects from teenage motherhood as has been found in many previous US and UK studies. We predict outcomes for African mothers who are age 40 in 2002 for 'all mothers' sample and the 'educated women' sample. We also predict outcomes for African mothers aged 24 in 2002 for the 'young women' sample. The results show that the proportion who completed high school differs substantially between those who had a teenage birth and those who did not both at age 40 and at age 24. Having completed high school increases wealth which can be seen by comparing the outcomes for the 'educated women' sample to the outcome of the 'all mothers' sample.

We further analyse women who are aged from 18 to 24 in 2002 by fitting single equations probit models of high school completion and teenage motherhood when treating both decisions as independently to each other. We control for population group, age, HIV prevalence rates and the propensities of the kind of contraceptive used by the group the woman belongs to. The results show that teenage childbearing has strong negative impacts on completing high school. Contraceptive availability to young women has a strong positive effect on high school completion rates and negative effects on teenage childbearing. In another analysis, we take into account the endogeneity of teenage motherhood and observe the effect of teenage childbearing on high school completion risk. For this reason, we estimate a 2SLS model on the joint determination of the probability of teenage motherhood and completing high school, identifying by abortion rates, the numbers of doctors and nurses by region and the distance to the nearest clinic. All the instruments are sisgnificant except for the regional abortion rates. We find that the effect of teenage childbearing on high school completion risks is highly significant and a Hausman test shows that teenage birth is not exogenous to high school completion decisions.

Early motherhood is associated with exclusion from education and employment. Government policies should target young women through much more effective sex education and drawing attentions to the risks associated with unprotected and casual sex. Young women need to be educated on the consequences of teenage childbearing on their future since as found by chapter 5, teenage motherhood seriously hampers the chance of the young woman to complete high school.

6.3 Final remarks

Some of the main results in this dissertation can be summarized as follows. We observe educational assortative mating in Britain and Sweden. Swedish pronatalist family policies are perceived to motivate Swedish women into early motherhood. Swedish women are in fact of on the average only 0.8 years younger than British women at first birth. This is because Swedish women are older when they finish education. But once Swedish women have formed a union, they are quicker to enter motherhood compared to British women. British couples stay longer in a couple before having a child. This implies that Swedish policies have made it affordable to start families earlier than their British counterparts.

In South Africa, there are on the average 4 marriageable African men for 10 African women at age 30 if marriageable men are defined by the number of employed men. There are on the average 2 marriageable African men for 10 African women if marriageable men are defined by the number of men with sufficient income. These poor marriage markets may explain the fact that 48% of African mothers in the age group 20-40 remain single. By contrast 78% of White mothers in the same age group are married. These White women have on the average 8 marriageable men for 10 women at age 30 if marriageable men are defined by either the number of employed men or the number of men with sufficient income. Some of

these African women would have married if they were exposed to more favourable marriage markets and if they were themselves better educated. The advice that flows from this analysis may be that postponement of motherhood may make women more marriageable. Investment in education and training by both men and women would make them more employable, which would in turn make them more marriageable.

We also find in South Africa as in most western countries the higher her level of education the later a woman schedules births and a decrease in completed fertility with increased education. African women give birth to their first child earlier compared to the other population groups and attain relatively higher completed fertility while White women postpone first birth and attain relatively lower completed fertility. Differences in education between population groups account for a substantive part (up to 40%) of the difference in completed fertility between the population groups. There are still behavioural differences between African and White women even if education is hold constant. Particularly African women would have more teenage births. Our finding also indicate that teenage motherhood in South Africa lead to adverse future outcome as such mothers have on the average lower completed educational achievement. On the other hand the youngest cohorts of African women born 1980-1984 have almost halved their probability of having a teenage birth in comparison to the cohorts born 1960-1964. We envisage educational policies aimed at African and Coloured women would achieve higher educational attainment in these groups and thus may close the fertility gaps between all the population groups.

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Samenvatting in het Netherlands

De afgelopen decennia zijn familiestructuren sterk veranderd. De acceptatie van zowel ongetrouwd moederschap alsook echtscheidingen heeft tot een toename van alleenstaande moeders geleid. De gestegen arbeidsmarktparticipatie van vrouwen heeft bijgedragen aan een toename van investeringen in menselijk kapitaal (human capital) door vrouwen, welke op hun beurt geleid hebben tot het uitstellen van het krijgen van kinderen, hogere kinderloosheid en kleinere gezinnen. Dit proefschrift bestaat uit vier hoofdstukken waarin beslissingen betreffende het huwelijk en het krijgen van kinderen in Zuid Afrika onderzocht worden met daarbij vergelijkingen met Groot-Brittannië en Zweden. Ondanks het feit dat deze landen alledrie momenteel een historisch laag geboortecijfer kennen, vertonen ze om diverse redenen verschillende patronen met betrekking tot het krijgen van kinderen en gezinsvorming. In de vier hoofdstukken van dit proefschrift worden huwelijksmarkten, het vinden van een partner en de planning van en het krijgen van kinderen in deze drie landen onderzocht.

In hoofdstuk 2 onderzoeken we wie met wie trouwt en de preferenties met betrekking tot partnerkeuze bij Zweedse en Britse paren. We onderzoeken tevens het tijdstip van het aangaan van een relatie en van het krijgen van een eerste kind. We vergelijken daarbij Zweedse met Britse paren. De analyse beperkt zich tot koppels voor wie het tijdstip van beide gebeurtenissen - relatievorming en eerste kind - beschikbaar is. Voor deze analyse maken we gebruik van de BHPS en de HUS panel data sets. Een model wordt opgesteld voor het tijdstip van zowel het aangaan van een relatie alsook van het krijgen van het eerste kind voor verschillende combinaties van groepen op basis van hun opleidingsniveau. Hierbij maken we onderscheid tussen Zweedse en Britse paren geboren tussen 1930 en 1979. We nemen daarbij aan dat vrouwen zowel een planning voor investeringen in hun eigen menselijk kapitaal alsook een carrièreplanning hebben. Hieruit volgt dat er een optimale leeftijd is voor het aangaan van een relatie en voor het krijgen van het eerste kind. In een eerste stap, die de functie met betrekking tot het aangaan van een relatie weergeeft, wordt een vergelijking voor de partnerkeuze geschat, gebaseerd op kenmerken met betrekking tot het individuele menselijke kapitaal en familieherkomst, alsook op huwelijksmarktindicatoren. Het econometrische model dat hiervoor wordt gebruikt is een multinominaal logit model.

De resultaten laten zien dat relaties deels worden gevormd op basis van opleidingsniveaus, waarbij de meeste mensen kiezen voor een partner met hetzelfde opleidingsniveau als zijzelf. Negen categorieën zijn gecreëerd op basis van de opleidingsniveaus, gebruikmakend van voorspelde kansen met betrekking tot het aangaan van een relatie gegeven het individuele opleidingsniveau en andere achtergrondvariabelen. In een tweede stap wordt de mate van relatievorming en de geboorte van het eerste kind geschat. Hiervoor wordt gebruik gemaakt van duurmodellen waarbij de voorspelde opleidingscategorieën en andere vaste en tijdsafhankelijke variabelen als verklarende variabelen dienen. Tevens wordt er met niet waargenomen individuele heterogeniteit rekening gehouden (een Weibull specificatie). De resultaten laten zien dat vrouwen uit hogere socio-economische klassen zowel een relatie als het ouderschap uitstellen. Een

toename in de hoeveelheid geaccumuleerd menselijk kapitaal, een langere opleidingsduur en ongunstige arbeidsmarktcondities vertragen de overgang naar zowel een relatie alsook het ouderschap. Zweedse vrouwen gaan op latere leeftijd een relatie aan, maar als de relatie eenmaal gevormd is, besluiten zij sneller om een kind te krijgen. Het effect van niet waargenomen individuele heterogeniteit is alleen significant voor de tijd tussen de partnerkeuze en het eerste kind.

In hoofdstuk 3 modelleren we de keuze van vrouwen op de huwelijksmarkt als uitkomst van de huwelijkskeuze van zwarte Zuid-Afrikaanse moeders. De motivatie voor deze opzet is het lage huwelijkspercentage onder zwarte Zuid-Afrikaanse moeders in de leeftijd van 20-40 jaar. Wij betogen dat dit veroorzaakt wordt door de lage man/vrouw-ratio (sekse ratio) van 91,8 die lager is dan bij blanke Zuid-Afrikanen. Becker's theorie voorspelt dat deze ratio gevolgen heeft voor het aandeel vrouwen dat alleenstaand blijft. Deze voorspelling is geanalyseerd in een aantal Amerikaanse studies. In dit hoofdstuk toetsen wij de hypothese dat wanneer de sekse ratio afneemt, zwarte Zuid-Afrikaanse vrouwen met tenminste een kind, eerder een minder aantrekkelijke samenlevingsvorm kiezen. Wij ordenen de huwelijksstaat als volgt: van minst attractief, 1) ongetrouwd, via 2) samenwonend en 3) traditioneel huwelijk naar meest attractief, zijnde 4) burgerlijk huwelijk.

We definiëren huwelijksmarkten op districtsniveau voor 53 districten, voor iedere bevolkingsgroep apart, gebruikmakend van de volkstelling van 2001 om de regionale verhoudingen tussen de seksen te berekenen. Partnerbeschikbaarheid wordt gedefinieerd als 1) het aantal mannen, 2) het aantal werkende mannen, 3) het aantal mannen met een voltooide opleiding, of 4) het aantal mannen met voldoende inkomen. De sekse ratio's laten zien dat er een groter aanbod van mannen bestaat in stedelijke gebieden dan op het platteland. Bovendien hebben stedelijke gebieden over het algemeen een grote instroom van migrantenarbeiders omdat de meeste mijnen, de grote commerciële boerenbedrijven en andere werkverschaffers (werkelijk of verondersteld) zich hier bevinden. Wij schatten ordered probit modellen om de determinanten vast te stellen van het type relatie van Zuid-Afrikaanse moeders in de leeftijd van 20-40 jaar. We corrigeren daarbij ondermeer voor leeftijd, bevolkingsgroep, religie, stedelijke gebieden, werkgelegenheid en regionale werkeloosheid. In een tweede analyse zijn variabelen toegevoegd, welke endogeen zijn voor de huwelijkskeuze, zoals opleiding en inkomen, om te corrigeren voor de heterogeniteit van vrouwen.

De uitkomst laat zien dat zwarte Zuid-Afrikaanse vrouwen een minder wenselijk huwelijk hebben vergeleken met blanke Zuid-Afrikaanse vrouwen. Ook heeft een werkende vrouw met een laag inkomen, *ceteris paribus*, minder kans op een goed huwelijk dan een niet-werkende vrouw. Echter, een vrouw met een hoog of middelhoog inkomen heeft een grotere kans op een goed huwelijk dan een niet-werkende vrouw. Aansluiting bij een religieuze groepering levert ook een positieve bijdrage aan het huwelijk terwijl niet-religieuze vrouwen de grootste kans hebben om ongetrouwd te blijven. Woonachtig zijn in een stedelijk gebied heeft een licht negatief effect op het huwelijk. De kans op een goed huwelijk is aanzienlijk groter in gebieden met een lage werkeloosheid. Een verandering van de definitie van de sekse ratio's van huwbare mannen

resulteert in een verhoogde beschikbaarheid van economisch aantrekkelijke mannen (mannen met voldoende inkomen of met een baan), wat in hoge mate bijdraagt aan een verschuiving naar een betere huwelijksstaat. Beschikbaarheid van hoog opgeleide mannen is ook belangrijk voor een goed huwelijk bij zwarte Zuid-Afrikanen, terwijl dit effect negatief is bij blanke Zuid-Afrikanen. De geschatte resultaten suggereren dat zowel het aantal alsook de kwaliteit van huwbare mannen een belangrijke rol spelen bij de huwelijkskeuze van vrouwen met minstens één kind.

Een voorspelling waarbij zwarte Zuid-Afrikaanse vrouwen aan de huwelijksmarkt van blanke Zuid-Afrikaanse vrouwen deelnemen met bovendien opleidingsniveaus gelijk aan die van de blanken, resulteert in een verhoging van hun huwelijkskansen met 8%. Dit impliceert dat in dit geval we nog steeds verwachten dat slechts 44% van de zwarte Zuid-Afrikaanse vrouwen gaat trouwen, zelfs bij goede huwelijksmogelijkheden en verbeterde opleidingsniveaus, dit ten opzichte van 86% van de blanke Zuid-Afrikaanse vrouwen. Een gelijksoortige voorspelling, maar dan slechts voor hoog opgeleide zwarte Zuid-Afrikaanse vrouwen, resulteert in een percentage van bijna 60% getrouwde vrouwen, en daarbinnen bijna 50% getrouwd in een burgerlijk huwelijk. Dus, hoog opgeleide zwarte Zuid-Afrikaanse vrouwen gedragen zich anders. Deze uitkomsten bevestigen dat niet alleen raciale verschillen de oorzaak zijn van slechte huwelijksvooruitzichten voor zwarte Zuid-Afrikaanse vrouwen. Onze resultaten wijzen erop dat deze conclusie stand houdt, zelfs wanneer we corrigeren voor variabelen welke te maken hebben met de beslissing betreffende de huwelijkskeuze. Wellicht leidt het uitstellen van het moederschap tot een stijging van de kans dat een vrouw trouwt met de vader van haar kind.

In hoofdstuk 4 schatten wij een duurmodel met meervoudige tijdsspannen voor alle geobserveerde aantallen kinderen om vast te stellen welke rol opleiding en bevolkingsgroep spelen in het uitstellen van het eerste kind en in het totale aantal kinderen voor alle vrouwen tussen 18-50 jaar in Zuid Afrika, gebruikmakend van de General Household Survey 2002. Dit omdat van 1981 tot 2005 het totale kindertal in Zuid-Afrika is gedaald van een geschat niveau van 4.6 naar 2.8 kinderen per vrouw. De relatieve verschillen tussen de bevolkingsgroepen blijven echter groot. Wij analyseren in welke mate het verschil in opleidingsniveau bij vrouwen het verschil verklaart tussen bevolkingsgroepen in het tijdstip van de geboorte van het eerste kind en de uiteindelijke gezinsgrootte. In het eerste deel van de analyse schatten wij duurmodellen (Cox proportionele hazard modellen) voor elke geboorte. Daarna voeren we Monte Carlo simulaties uit, waarbij voor iedere leeftijd geboortes worden gesimuleerd voor vrouwen van 12 tot 40 jaar. We nemen als referentiepunt een zwarte Zuid-Afrikaanse vrouw die is geboren tussen 1960 en 1964 met een middelbaar opleidingsniveau wonende in Kwazulu-Natal. Onze bevindingen laten zien dat er raciale verschillen zijn in de leeftijd waarop een vrouw haar eerste kind krijgt. Zwarte Zuid-Afrikaanse vrouwen krijgen hun eerste kind op jongere leeftijd vergeleken met andere bevolkingsgroepen en vormen relatief grotere gezinnen, terwijl blanke Zuid-Afrikaanse vrouwen het krijgen van kinderen uitstellen en kleinere gezinnen vormen. De kans dat blanke Zuid-Afrikaanse vrouwen een derde kind krijgen is gering. Kinderloosheid wordt geschat op 10% bij zwarte Zuid-Afrikaanse vrouwen en op 16% bij blanke Zuid-Afrikaanse vrouwen.

In lijn met eerdere studies vinden wij dat, hoe hoger het opleidingsniveau, hoe later vrouwen hun eerste kind krijgen en hoe lager het aantal kinderen. Vrouwen met enkel basisonderwijs krijgen gemiddeld 3.1 kinderen, terwijl vrouwen met een middelbare school diploma gemiddeld 1.9 kinderen krijgen. Een groot aantal kinderen komt meer voor bij laag opgeleide vrouwen en bij vrouwen die als tiener een kind hebben gekregen. Verschil in opleidingsniveau tussen de bevolkingsgroepen draagt voor een groot deel (tot 40%) bij aan de verschillen in gezinsgrootte tussen de bevolkingsgroepen. Er kan een soort inhaalslag plaatsvinden aan het eind van de opleiding bij vrouwen die op hogere leeftijd hun eerste kind hebben gekregen. Bij de jongere cohorten vrouwen zien wij uitstel van het krijgen van kinderen. Bij de groep vrouwen geboren tussen 1980-1994 is de kans op tienermoederschap gehalveerd in vergelijking met de groep geboren tussen 1960-1964. Tevens laten de schattingsresultaten zien dat de dood van een kind de tijdsduur verkort tot de geboorte van het volgende kind, waarschijnlijk omdat vrouwen snel het verlies van een kind willen compenseren om de optimale geplande gezinsgrootte te bereiken.

In hoofdstuk 5 bestuderen we of voor Zuid-Afrikaanse vrouwen, die vroeger tienermoeder zijn geweest, de sociaal-economische positie in 2002 hierdoor negatief beïnvloed is. We gebruiken dezelfde dataset als in het vorige hoofdstuk. We stellen verschillende modellen op voor steekproeven uit verschillende populaties: “alle vrouwen”, “alle moeders”, en “opgeleide vrouwen”, allen in de leeftijd van 18 tot 50 jaar en de groep “jonge vrouwen” van 18 tot 24 jaar. De reden voor het bestuderen van deze verschillende populaties is, dat de populatie “alle vrouwen” zowel kinderloze vrouwen alsook moeders bevat en men kan betogen dat de juiste vergelijking die is tussen vrouwen die tienermoeder zijn geweest en andere vrouwen die op latere leeftijd kinderen hebben gekregen. De motivatie voor het aparte gebruik van de populatie “opgeleide vrouwen” is dat opleiding tot een verschillend gedrag zou kunnen leiden. De populatie “jonge vrouwen” wordt apart bestudeerd omdat zij het risico van tienerzwangerschap recent ervaren hebben in een Zuid-Afrika dat sinds de laatste jaren nieuwe instituties kent.

Wij onderzoeken uitkomsten zoals voltooiing van de middelbare school, welvaart, huwelijkse staat en arbeidsmarktvoorwaarden in 2002. Onze belangrijkste bevindingen zijn dat tienermoederschap een negatief effect heeft op het voltooien van de middelbare school, maar voor de meeste andere uitkomsten vinden we dit negatieve effect van tienermoederschap niet. Dit in tegenstelling tot wat vele eerdere studies in de Verenigde Staten en Groot Brittanië wel vonden. Wij voorspellen de uitkomsten voor zwarte Zuid-Afrikaanse moeders, die in 2002 40 jaar waren voor de populaties “alle moeders” en “opgeleide vrouwen”. We voorspellen tevens de uitkomsten voor zwarte Zuid-Afrikaanse moeders die in 2002 24 jaar waren in de populatie “jonge vrouwen”. De resultaten laten zien dat het aandeel vrouwen dat de middelbare school voltooid heeft, enorm verschilt tussen de groep die tienermoeder geweest is en de groep die dat niet geweest is, zowel op 40-jarige alsook op 24-jarige leeftijd. Een voltooide middelbare schoolopleiding verhoogt de welvaart; dit wordt duidelijk door de uitkomsten van de groep “opgeleide vrouwen” met die van de groep “alle moeders” te vergelijken.

Verder hebben we de groep vrouwen geanalyseerd die in 2002 tussen 18-24 jaar waren door het schatten van univariate probit modellen voor de voltooiing van de middelbare

school en voor tienermoederschap, waarbij beide als onafhankelijk van elkaar beschouwd zijn. Wij corrigeren voor bevolkingsgroep, leeftijd, HIV ratio en de mate waarin diverse typen anticonceptie gebruikt worden door de verschillende populatiegroepen. De resultaten laten een duidelijk negatief effect zien van tienermoederschap op de voltooiing van de middelbare school. Beschikbaarheid van anticonceptie voor jonge vrouwen heeft een sterk positief effect op de voltooiing van de middelbare school en een negatief effect op tienerzwangerschap. In een andere analyse houden we rekening met de endogeniteit van het tienermoederschap en observeren we het effect van tienermoederschap op het voltooien van de middelbare school. Hiertoe schatten we een 2SLS model voor de gecombineerde vaststelling van de kans op tienermoederschap en het voltooien van de middelbare school, geïdentificeerd door middel van het aantal abortussen, het aantal doktoren en verpleegsters per regio en de afstand tot de dichtstbijzijnde kliniek. Al onze instrumenten zijn significant, met uitzondering van het aantal abortussen per regio. We vinden dat het effect van tienermoederschap op de voltooiing van de middelbare school sterk significant is en een Hausman test laat zien dat het krijgen van een kind als tiener niet exogeen is voor de beslissing om de middelbare school te voltooien.

Tienermoederschap wordt geassocieerd met uitsluiting van opleiding en werkgelegenheid. Het regeringsbeleid dient zich te richten op jonge vrouwen door middel van een veel effectievere seksuele voorlichting en door te attenderen op de risico's voortvloeiende uit onbeschermde seks. Jonge vrouwen dienen te worden voorgelicht over de consequenties van tienerzwangerschap voor hun toekomst aangezien, zoals gevonden in hoofdstuk 5, tienermoederschap een ernstige belemmering vormt voor jonge vrouwen om hun middelbare school te voltooien.

Tot slot kunnen enkele van de belangrijkste resultaten van dit proefschrift als volgt worden samengevat. We vinden dat in Groot-Brittannië en Zweden partnerkeuze gerelateerd is aan opleidingsniveaus. Verder zien we dat Zweeds familiebeleid, dat pro-geboorte is, Zweedse vrouwen motiveert om op jongere leeftijd moeder te worden. Zweedse vrouwen zijn gemiddeld wel slechts 0.8 jaar jonger dan Britse vrouwen bij hun eerste kind, maar dit is omdat Zweedse vrouwen ouder zijn wanneer zij hun opleiding voltooien. Echter, zodra Zweedse vrouwen een relatie aangaan, krijgen zij sneller een kind vergeleken met Britse vrouwen. Britse paren blijven langer kinderloos. Dit veronderstelt dat het Zweedse beleid het financieel mogelijk maakt om eerder een gezin te vormen dan bij hun Britse tegenhangers het geval is.

In Zuid Afrika zijn er gemiddeld 4 huwbare zwarte Zuid-Afrikaanse mannen voor 10 zwarte Zuid-Afrikaanse vrouwen op 30-jarige leeftijd, als huwbare mannen gedefinieerd worden als het aantal werkende mannen. Er zijn gemiddeld 2 huwbare zwarte Zuid-Afrikaanse mannen voor 10 zwarte Zuid-Afrikaanse vrouwen indien huwbare mannen worden gedefinieerd als mannen met voldoende inkomen. Deze slechte huwelijksmarkt is mogelijk een verklaring voor het feit dat 48% van de zwarte moeders in de leeftijdsgroep van 20-40 jaar alleenstaand blijven. Daartegenover staat dat 78% van de blanke moeders van dezelfde leeftijdsgroep gehuwd zijn. Deze blanke vrouwen hebben een gemiddelde van 8 huwbare mannen voor 10 vrouwen op 30-jarige leeftijd, zowel wanneer huwbare mannen worden gedefinieerd als het aantal werkende mannen alsook als het aantal

mannen met voldoende inkomen. Sommige van deze zwarte Zuid-Afrikaanse vrouwen zouden gehuwd zijn geweest indien zij toegang hadden gehad tot een gunstiger huwelijksmarkt of indien zij hoger opgeleid zouden zijn. Het advies dat volgt uit deze analyse is dat het uitstel van moederschap een vrouw beter huwbaar maakt. Investering in opleiding en training maakt zowel vrouwen als mannen beter inzetbaar in de arbeidsmarkt, wat op zijn beurt weer de kansen op een huwelijk vergroot.

Wij zien ook in Zuid-Afrika, evenals in de meeste westerse landen, dat hoe hoger het opleidingniveau is, des te later plannen vrouwen hun eerste kind en des te kleiner is de gezinsgrootte. Zwarte Zuid-Afrikaanse vrouwen krijgen eerder hun eerste kind vergeleken met andere bevolkingsgroepen en vormen relatief grotere gezinnen, terwijl blanke Zuid-Afrikaanse vrouwen het krijgen van hun eerste kind uitstellen en relatief minder kinderen krijgen. Verschil in opleidingsniveau tussen de bevolkingsgroepen draagt voor een substantieel deel (tot 40%) bij aan het verschil in gezinsgrootte. Bovendien zijn er gedragsverschillen tussen zwarte Zuid-Afrikaanse en blanke Zuid-Afrikaanse vrouwen als we uitgaan van een gelijk opleidingsniveau. In het bijzonder zouden zwarte Zuid-Afrikaanse vrouwen meer tienerzwangerschappen laten zien. Onze bevindingen duiden er ook op dat tienermoederschap in Zuid-Afrika leidt tot slechtere toekomstperspectieven, daar deze vrouwen over het algemeen een lager opleidingsniveau hebben. Aan de andere kant laat de groep jonge vrouwen van zwarte Zuid-Afrikaanse vrouwen, geboren tussen 1980-1984 een halvering zien van de kans op het krijgen van een kind op tienerleeftijd in vergelijking met de groep vrouwen geboren tussen 1960-1964. Wij voorzien dat een onderwijsbeleid gericht op zwarte Zuid-Afrikaanse vrouwen en vrouwen van gemengde afkomst een hoger opleidingsniveau in deze groepen zal bewerkstelligen en daardoor de verschillen in gezinsvorming tussen alle bevolkingsgroepen zullen verdwijnen.

The Tinbergen Institute is the Institute for Economic Research, which was founded in 1987 by the Faculties of Economics and Econometrics of the Erasmus Universiteit Rotterdam, Universiteit van Amsterdam and Vrije Universiteit Amsterdam. The Institute is named after the late Professor Jan Tinbergen, Dutch Nobel Prize laureate in economics in 1969. The Tinbergen Institute is located in Amsterdam and Rotterdam. The following books recently appeared in the Tinbergen Institute Research Series:

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