FERTILITY AND THE CHANGING FEMALE EDUCATIONAL ATTAINMENT IN CROATIA

Ivan Čipin
University of Zagreb, Faculty of Economics and Business Zagreb, Department of Demography

Petra Međimurec
University of Zagreb, Faculty of Economics and Business Zagreb, Department of Demography

Silvija Vlah Jerić
University of Zagreb, Faculty of Economics and Business Zagreb, Department of Mathematics

Work in progress. Please do not cite.

1. INTRODUCTION

Fertility is a demographic process that can lead to significant changes in population size and structure, especially over the long run. In 1957, when the baby-boom era was in full swing in many western industrialized countries, below-replacement reproduction regime[1] started to manifest itself in socialist Croatia (Breznik et al., 1972). Persistently low fertility levels didn't go without consequence: Croatia's population has been declining for a quarter of a century, now reaching the same size as over 50 years ago[2].

A decreasing birth rate after the World War II came as a result of many factors, the most significant being the war losses of men, political and economic emigration, de-ruralisation and forced post-war industrialisation (Wertheimer-Baletić, 1971). Contrary to other socialist countries, Yugoslavia had difficulties in implementing pronatalist measures, largely due to high birth rates in some of its federal republics and autonomous provinces (e.g. Bosnia and Herzegovina, Kosovo). So, in spite of Croatia being a low fertility country for decades, universal pronatalist measures have not been introduced to the national policy agenda up until the 1990s.

Domestic demographers agree that development strategies introduced during the post-war period contributed to downward fertility trends over the 1960s (Wertheimer-Baletić, 1971). Communist authorities gave priority to developing heavy industries. On the other hand, consumer industries, housing and services were mainly put aside. The rapid growth of industrial capacities occurred without significant technological progress and was accompanied by a rather low productivity, thus creating space for a large labour demand (Sirotković, 1996). As the male labour force was already highly active, the resulting gap was offset by a substantial increase in female economic activity.

After the World War II up until 1991, Croatia was a part of Yugoslavia and, as such, a socialist country. Nevertheless, Croatia in many ways differed from the majority of other socialist countries in Europe. Croatia (going hand in hand with Slovenia) was not only the most developed federal republic of Yugoslavia, but also found itself among the most developed socialist countries in Central and Eastern Europe (Tomić-Koludrović and Petrić, 2007). The political regime in Yugoslavia was not under

[1] In 1957, the net reproduction rate fell below 1 and never since has risen above this number.
[2] According to Eurostat, Croatia's population at January 1 2016 was 4,190,669; the figure does not surpass the population size of 1963.

the influence of the Soviet Union and a Stalinist model of state socialism did not come to life. On the contrary, Yugoslavia established a unique economic order, known as self-management. During the socialist period, Croatian citizens were able to travel freely to foreign countries. A sizable number of workers went to seek temporary employment abroad, especially during the 1960s (Wertheimer-Baletić, 1971; Akrap, 2004). Therefore, the population was (at least partially) exposed to western values and had access to western commodities, while the level of economic development and standard of living were higher than in many other socialist countries. The economic downturn and recession in Croatia did not start after the fall of the socialist system but had already begun in the 1980s (Sirotković, 1996). Furthermore, Croatia inherited a respectable level of unemployment from the socialist period during the 1980s (Woodward, 1995). Such circumstances were, in almost all other European communist countries, a virtually unknown phenomenon.

The economic transition from socialism to capitalism in Croatia took place during the 1990s, under war circumstances, when almost a third of industrial capacities had been destroyed (Sirotković, 1996). The role of state in providing employment, social services and benefits underwent change over that period. Public enterprises lost their social function. The pressure of high unemployment, job insecurity and wage reductions made an influence on life events, including reproductive outcomes of generations born during the late 1960s and early 1970s.

Women born during the 1930s already exhibited below-replacement completed fertility. Many socioeconomic variables, including education, therefore no longer affected childbearing behaviour in the same way as over the periods of higher fertility (Breznik, 1991). This is not unexpected, as previous research on determinants of fertility in Yugoslavia found the weakest association between level of education and childbearing during a low fertility regime (Rašević, 1971).

From the 1950s up until the 1980s, the gender gap in economic activity was gradually decreasing in Croatia. As compared to male economic activity, female labour market participation grew much faster (Kerovec, 2003). Hence, women's share of total employment increased steadily over the specified time interval. In 1952, female employment accounted for roughly 28% of total employment. In 1978, this proportion went up to 39 % (Prpić, 1979). An upward trend continued up until the end of the 20th century, achieving its maximum at 46% in 1997 (Kerovec, 2003). Simultaneously, female education experienced a marked improvement. In 1960, women accounted for 32.8% of students who graduated from higher education institutions. This proportion rose to 44.6% in 1980, came to 53.7% in 1990 and reached as much as 60.8 % in 2010 (CBS, 2016a). However, a deeper insight into female career opportunities reveals a lingering horizontal gender segregation. Certain professions are still typically female dominant (e.g. education, health and welfare) (CBS, 2016a).

Accordingly, this paper investigates the aggregate relationship between completed fertility and educational attainment in Croatia. The focus is on women born between 1930 and 1970. The specified time span allows us to investigate childbearing patterns over a period ranging from the baby boom up until post-socialist transition years in Croatia. We contribute to existing literature on macro-level factors related to childbearing outcomes (see e.g. Brzozowska, 2015) by considering both level of education and field of education as possible sources of completed fertility differentials. Our research is based on detailed 2011 Population Census data. The main goal of the present study is to

assess the effects of compositional changes in educational attainment on completed fertility dynamics. We introduce marital status as an additional factor in our analyses.

In line with previous research (see the next chapter), we expect to find large and persistent differences in completed fertility by level of education. We hypothesise that the overall completed fertility decline in Croatia can be attributed to female educational expansion. Moreover, we expect women trained to perform jobs in education, health and welfare to exhibit higher completed fertility across cohorts. A changing distribution of female population by field of education might, therefore, also play a role in explaining childbearing patterns.

2. BACKGROUND

In low fertility settings, education usually remains constant throughout a woman's prime reproductive ages. This makes it a particularly suitable indicator when comparing fertility levels across different age cohorts. Moreover, education is shown to be one of the major drivers of the increase in female labour market participation. Many studies link women's education and employment to fertility behaviour and work-family balance (Blossfeld and Huinik, 1991; Liefbroer and Corijn, 1999; Brewster and Rindfuss, 2000).

Demographers (Martín-García, 2008; Balbo et al., 2013) recognise female education as one of the main determinants of the timing of first births, and of overall fertility levels. Therefore, numerous studies have examined the link between fertility and women's educational level (e.g. Hoem, 1986; Blossfeld and Huinik, 1991; Liefbroer and Corijn, 1999; Skirbekk, 2008).

The economic perspective on the relationship between education and fertility (Becker, 1981) predicts the postponement of motherhood and fewer children for women with more formal schooling. Becker's New Home Economics approach to fertility presumes that tertiary educated women prioritise quality over quantity of children. Within this context, better educated women show higher economic independence and delay or completely forgo parenting due to larger opportunity costs of having children. Women with tertiary degrees tend to find better-paid jobs and a withdrawal from the labour market might lead to skill depreciation. Generally, the more educated a woman is, the harder it becomes to combine family and professional responsibilities.

On the other hand, the Second Demographic Transition concept (Van de Kaa, 1987; Lesthaeghe, 1995) puts emphasis on cultural factors and considers personal values and beliefs as a leading determinant of reproductive behaviour. According to a cultural explanation of low fertility, within the framework of the Second Demographic Transition theory, self-fulfillment is the main goal in life and having children is becoming less important. As a result, entry into marriage and having children are being postponed to later ages up until other goals in life, such as acquiring a desired level of education and a satisfactory position in the labor market, are met. A woman's level of education can influence social norms regarding family size to a notably large extent. Less educated women tend to marry earlier and are more prone to staying economically inactive and are, consequently, expected to have more children.

However, newer research indicates that field of education might also play a role in understanding fertility behaviour. Some authors (Hoem et al., 2006a, 2006b) assert that the choice of a specific study discipline explains more of the variation in reproductive outcomes than does the completion of a certain level of education. So far, the idea has received relatively little research attention, especially

in the former socialist countries in Europe. This is partly due to limited access to sufficiently detailed data.

Numerous authors find that field of education significantly affects fertility decision making (Lappegård and Rønsen, 2005; Hoem et al., 2006a, 2006b; Martín-García and Baizán, 2006; Neyer and Hoem, 2008; Bagavos, 2010; Rønsen and Skrede, 2010; Van Bavel, 2010; Tesching, 2012; Begall and Mills, 2013; Michelmore and Musick, 2013), even after controlling for level of education. They all argue that individuals trained to perform similar jobs resemble each other more as compared to individuals holding the same level of education. In other words, those sharing a specific field of education might represent a homogenous group in terms of preferences, exposure to labour market conditions and life course experiences.

Some professions appear to offer a family-friendly environment and provide flexible or even part-time hours of employment. Then again, other professions are associated with non-standard work schedules, possibly aggravating the usage of formal childcare services. Furthermore, women taking longer parental leaves oftentimes face skill depreciation (Martín-García and Baizán, 2006), which is largely the case in male dominant technical vocations (Hoem et al., 2006a). Specialising in education, health and welfare apparently seems to act as a fertility booster (Lappegård and Rønsen, 2005; Hoem et al., 2006a; Neyer and Hoem, 2008; Bagavos, 2010; Begall and Mills, 2012; Tesching, 2012). The odds of becoming a mother decrease among tertiary educated women who completed training in humanities and social sciences in Norway (Lappegård and Rønsen, 2005). Academic orientations concerned with the care of individuals or those emphasising interpersonal skills positively influence the timing of first births in Spain (Martín-García and Baizán, 2006). Additionally, fertility postponement is found to be more prevalent among female graduates from subject groups that are typically male dominant (Van Bavel, 2010).

The choice of a specific study discipline shapes the social context both during and after formal schooling, thus showing the capacity to affect fertility preferences (Martín-García and Baizán, 2006; Van Bavel, 2010). Still, field of education frequently conceals a considerable amount of occupational heterogeneity. Finally, as McDonald and Kippen (2009) argue, the relationship between field of education and reproductive behaviour could be spurious because family-oriented women are more likely to seek a degree which will, later on, dampen a possible work-family conflict.

3. ANALYTICAL STRATEGY

3.1. Data

The data used in the present paper are drawn from the Census of Population, Households and Dwellings 2011 (CBS, 2016b) and refer to women 15 years old and older by year of birth and number of live-born children. Available information is further classified by marital status, level of education and field of education. The categories corresponding to these factors are

marital status, I:

- never married
- ever married

level of education, J:

- low

- middle
- high

field of education, K:
- general programmes
- education
- humanities and arts
- social sciences, business and law
- science
- engineering, manufacturing and construction
- agriculture
- health and welfare
- services
- other
- no formal schooling.

The analyses are restricted to women born between 1930 and 1970. The youngest analysed cohort was 40 years old at the time of data collection. We assume these women had mostly finished their reproductive careers and employ a common practice of disregarding a small share of fertility occurring at high childbearing ages (Kravdal and Rindfuss, 2008; Cohen, Kravdal and Keilman, 2011; Brzozowska, 2014).

In order to ensure comparability across cohorts, marital status distinguishes between never married and ever married women[3]. The categories considered for level of education are based on the International Standard Classification of Education (ISCED)[4]: low (ISCED levels 0, 1, 2), middle (ISCED levels 3A, 3C), high (ISCED levels 5A, 5B, 6). Field of education is sorted into broad classes composed of subject groups showing similarities[4] and treats women with no formal schooling as a separate category.

Having the form a multidimensional array, the data serve as an input for calculating completed fertility rates[5] by several sociodemographic subgroups (as determined by all possible factor combinations). Cases with missing values on marital status, level of education and field of education are for current purposes excluded from the analyses.

3.2. Methods

After a brief review of trends in completed fertility rates in Croatia, we apply decomposition techniques (Das Gupta, 1978; also see Kitagawa, 1955; Cho and Retherford, 1973) to study the components of the observed changes. There is no rule of thumb when choosing among a variety of decomposition methods (see e.g. Canudas Romo, 2003). However, in this case, Das Gupta's (1978) approach offers some advantages: (1) it is straightforward and capable of handling any number of factors, (2) the results are independent of the order in which the effects of (multiple) factors are

[3] Older cohorts exhibit a larger proportion of widowed women. The ever married category also includes currently married and divorced women.

[4] The coding of educational categories uses the 1997 ISCED version. For a comprehensive description, see http://www.uis.unesco.org/Library/Documents/isced97-en.pdf (1 August 2016).

[5] The highest birth order used is an open-ended group 19+. Women of unknown parity are removed prior to determining the total number of live-born children by particular sociodemographic subgroups.

computed and (3) no interaction term is involved (hence, the interpretation is simpler). Within the proposed framework, completed fertility rates for cohorts a and b, CFR^a and CFR^b respectively, may be defined as

$$CFR^a = \sum_i \sum_j \sum_k \left(\frac{n_{ijk}}{n}\right)^a CFR^a_{ijk}$$

$$CFR^b = \sum_i \sum_j \sum_k \left(\frac{n_{ijk}}{n}\right)^b CFR^b_{ijk}$$

where $\frac{n_{ijk}}{n}$ denotes the sociodemographic composition and ijk determines the sociodemographic subgroup (as dictated by all obtainable combinations of class variables). The difference between CFR^a and CFR^b is given as

$$\begin{aligned} CFR^b - CFR^a &= \sum_i \sum_j \sum_k \left(\frac{n_{ijk}}{n}\right)^b CFR^b_{ijk} - \sum_i \sum_j \sum_k \left(\frac{n_{ijk}}{n}\right)^a CFR^a_{ijk} \\ &= \sum_i \sum_j \sum_k \left[\left(\left(\frac{n_{ijk}}{n}\right)^b - \left(\frac{n_{ijk}}{n}\right)^a\right) * \frac{CFR^a_{ijk} + CFR^b_{ijk}}{2}\right] \\ &+ \sum_i \sum_j \sum_k \left[\left(CFR^b_{ijk} - CFR^a_{ijk}\right) * \frac{\left(\frac{n_{ijk}}{n}\right)^a + \left(\frac{n_{ijk}}{n}\right)^b}{2}\right] \end{aligned}$$

where $\sum_i \sum_j \sum_k \left[\left(\left(\frac{n_{ijk}}{n}\right)^b - \left(\frac{n_{ijk}}{n}\right)^a\right) * \frac{CFR^a_{ijk}+CFR^b_{ijk}}{2}\right]$ represents the structural component (i.e. the contribution of changes in sociodemographic composition to the overall difference) and $\sum_i \sum_j \sum_k \left[\left(CFR^b_{ijk} - CFR^a_{ijk}\right) * \frac{\left(\frac{n_{ijk}}{n}\right)^a + \left(\frac{n_{ijk}}{n}\right)^b}{2}\right]$ reflects the direct component (i.e. the contribution of changes in subgroup-specific rates to the overall difference).

The structural component is additionally split into sole effects of constituent factors (see Das Gupta, 1978, pp. 104–105). Expressions

$$I(I,J,K) = \sum_i \sum_j \sum_k \frac{CFR^a_{ijk} + CFR^b_{ijk}}{2} \frac{\left(\frac{n_{ijk}}{n_i}\right)^a + \left(\frac{n_{ijk}}{n_i}\right)^b}{2} \left(\left(\frac{n_i}{n}\right)^b - \left(\frac{n_i}{n}\right)^a\right)$$

$$J(I,J,K) = \sum_i \sum_j \sum_k \frac{CFR^a_{ijk} + CFR^b_{ijk}}{2} \frac{\left(\frac{n_{ijk}}{n_{ij}}\right)^a + \left(\frac{n_{ijk}}{n_{ij}}\right)^b}{2} \frac{\left(\frac{n_i}{n}\right)^a + \left(\frac{n_i}{n}\right)^b}{2} \left(\left(\frac{n_{ij}}{n_i}\right)^b - \left(\frac{n_{ij}}{n_i}\right)^a\right)$$

$$K(I,J,K) = \sum_i \sum_j \sum_k \frac{CFR^a_{ijk} + CFR^b_{ijk}}{2} \frac{\left(\frac{n_i}{n}\right)^a + \left(\frac{n_i}{n}\right)^b}{2} \frac{\left(\frac{n_{ij}}{n_i}\right)^a + \left(\frac{n_{ij}}{n_i}\right)^b}{2} \left(\left(\frac{n_{ijk}}{n_{ij}}\right)^b - \left(\frac{n_{ijk}}{n_{ij}}\right)^a\right)$$

depict a particular order of factors, specifically marital status, I, level of education, J and field of education, K. Analogous equations consistent with other orders are derived accordingly by proper substitution of indices. Finally, with

$$I \text{ effect} = \frac{1}{6}[I(I,J,K) + I(I,K,J) + I(J,I,K) + I(J,K,I) + I(K,I,J) + I(K,J,I)]$$

$$J \text{ effect} = \frac{1}{6}[J(I,J,K) + J(I,K,J) + J(J,I,K) + J(J,K,I) + J(K,I,J) + J(K,J,I)]$$

$$K \text{ effect} = \frac{1}{6}[K(I,J,K) + K(I,K,J) + K(J,I,K) + K(J,K,I) + K(K,I,J) + K(K,J,I)]$$

we obtain the estimates of desired effects. The acquired values represent averages of the figures derived from all possible orders in which the effects of examined factors can be computed.

The outlined decomposition procedures are repeated for all neighbouring cohorts in 5-year intervals. This reveals a temporal mechanism relating shifts in women's educational portrait to established fertility patterns in Croatia (while controlling for a gradually increasing prevalence of the never married female population).

Lastly, we conduct direct standardization (see e.g. Carmichael, 2016, pp. 55–73) to show how the CFR would have behaved if the female population structure had remained constant and produce parity progression ratios (see e.g. Carmichael, 2016, pp. 287–292) to gain a more detailed assessment of the changes in reproductive outcomes across sociodemographic strata. Parity progression ratios capture the conditional probability of having another child (parity p) among women achieving a certain birth order (parity $p-1$). While it is possible to construct period parity progression ratios to discuss fertility trends (see e.g. Feeney, 1991), existing literature recognises the deficiencies it holds as a demographic measure (Kohler and Ortega, 2002) and more usually relies on computations dealing with real female cohorts (see e.g. Frejka and Sardon, 2007). We hereby also develop cohort parity progression ratios, namely $PPR1$, $PPR2$ and $PPR3$ with

$$PPRp = \frac{\text{number of women at parity } p \text{ or more}}{\text{number of women at parity } p-1 \text{ or more}}, p = 1,2,3$$

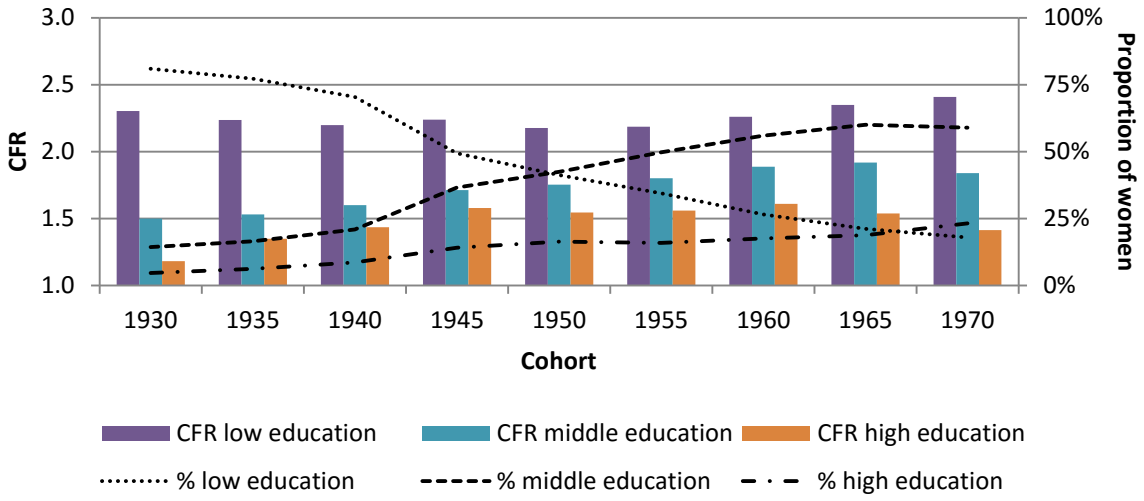
and expand the calculations over the main factors included in our analyses.

4. RESULTS

4.1. Descriptive findings

The educational expansion among cohorts of women under study is indisputable but completed fertility differentials appear to persist. As shown in Figure 1, better educated women, on average, finished their reproductive careers with fewer children. Albeit mildly fluctuating, completed fertility of women with low education remained well above the replacement threshold. Their share, however, fell sharply from over 75% (cohort 1930) to less than 20% (cohort 1970). For most of the cohorts, completed fertility of women with middle education actually rose (from 1.5 in 1930 to over 1.8 in 1970). An increase in completed fertility of women with high education occurred among older cohorts. Yet, it then levelled off and began to decline for women born after 1960, ultimately reaching a value of 1.4 (cohort 1970).

Figure 1. Completed fertility and distribution of women by cohort and level of education



Source: own calculations based on 2011 Population Census data.

We now turn to examine completed fertility by field of education. The proportion of women with low education having no formal schooling dropped continuously across cohorts (from more than 15% in 1930 to barely 3% in 1970). Other women with low education are classified as having finished general programmes and their completed fertility went up from 2.1 (cohort 1930) to 2.4 (cohort 1970). A more elaborate review of completed fertility disaggregated by subject groups is provided for women with middle (Table 1) and high (Table 2) education.

Table 1. Completed fertility and distribution of <u>middle</u> educated women by cohort and field of education

Field of education	Proportion of women (%)					Completed fertility				
	1930	1940	1950	1960	1970	1930	1940	1950	1960	1970
General programmes	28.8	15.6	15.7	6.6	3.9	1.56	1.55	1.62	1.72	1.66
Education	6.5	2.9	0.6	2.1	0.9	1.60	1.67	1.81	1.83	1.64
Humanities and arts	0.6	0.4	0.5	0.4	0.6	1.56	1.27	1.52	1.41	1.56
Social sciences, business and law	27.3	40.6	40.2	41.9	35.2	1.40	1.56	1.75	1.86	1.78
Science	/	/	/	0.8	1.3	/	/	/	1.87	1.55
Engineering, manufacturing and construction	18.5	20.9	22.3	23.4	30.9	1.55	1.67	1.84	1.97	1.96
Agriculture	1.0	0.7	0.9	2.6	4.4	1.56	1.72	1.78	2.07	1.89
Health and welfare	7.6	7.0	6.8	9.4	5.9	1.34	1.57	1.76	1.89	1.81
Services	7.3	10.5	12.6	12.4	16.8	1.55	1.66	1.78	1.88	1.82
Other	2.3	1.5	0.4	0.4	0.2	1.60	1.88	1.79	1.97	1.70
Total	*100*	*100*	*100*	*100*	*100*	*1.50*	*1.60*	*1.75*	*1.89*	*1.84*

Source: own calculations based on 2011 Population Census data. Note: we omit values resulting from ≤10 observations.

The most notable change concerning the distribution of women with middle education refers to a diminishing fraction of training in general programmes, while completed fertility differentials exhibit some variation between cohorts. Referring to Table 1, the largest contrast in completed fertility rates occurs within the 1960 cohort, with women educated in agriculture having, on average, 0.66 children

more than women educated in humanities and arts. Expectedly, training in humanities in arts is associated with lower completed fertility (with the exception of the youngest cohort). However, women opting for this field of education take up a rather small share of the total as compared to other vocations.

Women with high education show a somewhat clearer pattern. Unsurprisingly, those trained to perform jobs in education are consistently found to have more children relative to other subject groups within the same cohorts. On the other hand, their proportion among women with high education almost halved in size across the observed cohort range. As indicated in Table 2, completed fertility differentials by field of education were substantially more pronounced within the youngest cohort as compared to the oldest cohort.

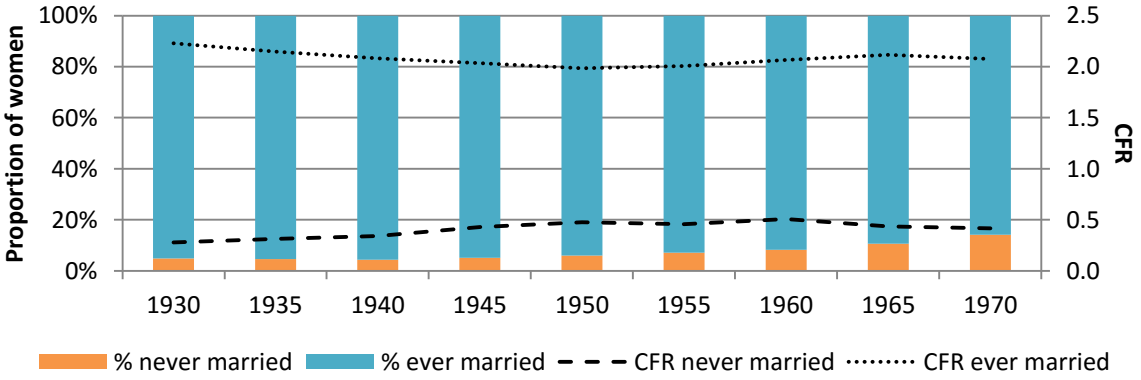
Table 2. Completed fertility and distribution of highly educated women by cohort and field of education

Field of education	Proportion of women (%)					Completed fertility				
	1930	1940	1950	1960	1970	1930	1940	1950	1960	1970
Education	29.9	29.1	18.9	18.7	15.5	1.42	1.63	1.68	1.73	1.58
Humanities and arts	15.3	14.2	12.7	10.7	13.6	1.01	1.32	1.40	1.42	1.24
Social sciences, business and law	20.2	27.9	34.4	40.6	33.2	1.02	1.35	1.53	1.59	1.40
Science	6.0	4.6	3.4	2.1	5.6	0.94	1.41	1.54	1.37	1.40
Engineering, manufacturing and construction	6.4	8.8	9.2	8.6	11.0	1.06	1.43	1.49	1.65	1.44
Agriculture	3.7	1.9	2.4	2.0	3.6	1.32	1.15	1.36	1.53	1.47
Health and welfare	16.2	11.7	14.6	13.2	11.2	1.27	1.36	1.59	1.71	1.43
Services	1.9	1.8	4.2	3.9	6.1	0.75	1.34	1.60	1.57	1.40
Other	/	/	/	/	/	/	/	/	/	/
Total	*100*	*100*	*100*	*100*	*100*	*1.18*	*1.44*	*1.54*	*1.61*	*1.41*

Source: own calculations based on 2011 Population Census data. Note: we omit values resulting from ≤10 observations.

Finally, Figure 2 presents completed fertility trends by marital status, as it is a factor included in our decomposition analyses. Although the share of unmarried women is gradually rising, especially within the youngest cohorts, the high prevalence of intermarriage reproduction is clearly visible.

Figure 2. Completed fertility and distribution of women by cohort and marital status



Source: own calculations based on 2011 Population Census data.

4.2. Components of cohort fertility differentials

We now present the decomposition results. The broadest conclusion concerning the oldest and the youngest cohort suggests that the structural effect strongly dominates the direct one (the upper panel of Table 3). More specifically, the changing composition of female population by marital status, level of education and field of education contributed to a decrease in the overall completed fertility by -0.724, while subgroup-specific rate increases amounting to 0.431 appear not to be strong enough to offset the aforementioned impact. In other words, completed fertility net of distributional changes in female population actually increased. A further decomposition of the combined effect of all considered factors seems to indicate that field of education played the most important role in the observed completed fertility decline: it accounts for over 40% of the total structural component. A more modest proportion of the structural component is attributed to changes in female distribution by marital status, which explains less than 25% of the total structural component.

The decomposition results regarding subsequent cohorts in 5-year intervals (the bottom panel of Table 3) show a persistently negative structural component, even over intervals which exhibit a positive change in completed fertility. The isolated effect of marital status turns from positive to negative and becomes largest in size among younger cohorts (1960 versus 1965, 1965 versus 1970). On the other hand, the changing educational portrait of female population solely explains the decline in completed fertility among older cohorts (1930 versus 1935, 1935 versus 1940) and continues to be prevalent among women born before 1960.

Table 3. Components analysis of change in completed fertility

Cohorts	Change in completed fertility	Direct component	Structural component	Effects of factors		
				Marital status	Level of education	Field of education
1930 versus 1970	**-0.293**	**0.431**	**-0.724**	**-0.164**	**-0.264**	**-0.296**
1930 versus 1935	-0.071	-0.032	-0.038	0.005	-0.014	-0.030
1935 versus 1940	-0.058	0.032	-0.090	0.005	-0.024	-0.071
1940 versus 1945	-0.052	0.091	-0.144	-0.009	-0.067	-0.067
1945 versus 1950	-0.060	0.001	-0.062	-0.013	-0.029	-0.020
1950 versus 1955	0.002	0.045	-0.043	-0.018	-0.013	-0.013
1955 versus 1960	0.043	0.086	-0.043	-0.015	-0.012	-0.015
1960 versus 1965	0.000	0.056	-0.056	-0.037	-0.010	-0.009
1965 versus 1970	-0.096	-0.014	-0.082	-0.052	-0.022	-0.008

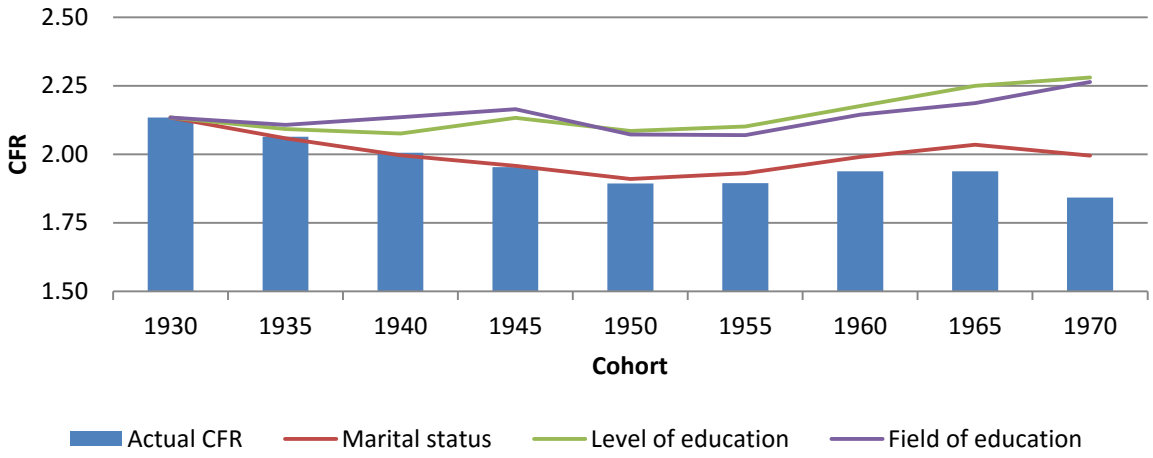
Source: own calculations based on 2011 Population Census data.

So, how would have completed fertility behaved if the composition of female population by marital status, level of education and field of education had remained constant?

We consider each of the factors separately and examine their contribution to completed fertility decline. Figure 3 compares the observed completed fertility rates to their directly standardized counterparts. Had the female population structure by field of education remained constant, completed fertility would have actually risen (albeit slightly) from 2.13 (cohort 1930) to 2.26 (cohort 1970). The same applies to level of education, with the gap between the real and directly

standardized completed fertility rates widening with time. A stable composition of female population by marital status would have been insufficient to keep completed fertility at or above the replacement level.

Figure 3. Actual and directly standardised completed fertility



Source: own calculations based on 2011 Population Census data. Note: the distribution of women born in 1930 by (1) marital status, (2) level of education, (3) field of education is used as the standard population.

However, without thoroughly reviewing the effects of different factor combinations, one might get a misleading impression on how the overall completed fertility decline is influenced by distributional changes in female population by level of education and field of education. Interestingly, as displayed in Table 4, the largest contributors to completed fertility change between the oldest and the youngest cohort are ever married women with low education (having some or no formal schooling). As a matter of fact, the majority of other structural component values are actually positive. Therefore, the observed completed fertility decline in Croatia is mostly attributable to a decreasing proportion of low educated women, whose completed fertility further increased over the analysed cohort range.

Perhaps surprisingly, the highest positive structural component values are found among ever married women who obtained training in engineering, manufacturing and construction, social sciences, business and law. These sociodemographic subgroups also exhibit an increase in completed fertility net of compositional changes in female population.

The decomposition findings referring to successive cohorts in 5-year intervals confirm a fundamental role of a shrinking share of women with low education. Table 5 shows the most negative structural component values resulting from our analyses. When compared to total structural component values (see the middle column in Table 3), it becomes obvious that the negative effects of distributional changes in female population mostly originated from a reducing size of the sociodemographic subgroup representing ever married women with low education. A decreasing proportion of ever married women with no formal schooling is found to have the most negative effect among older cohorts (1930 versus 1935, 1935 versus 1940), while a decreasing proportion of ever married women with low education in general programmes is found to have the most negative effect among younger cohorts (1940 versus 1945, 1945 versus 1950, 1950 versus 1955, 1955 versus 1960, 1960 versus 1965, 1965 versus 1970).

Table 4. Components analysis of change in completed fertility: a detailed examination of all factor combinations (the oldest versus the youngest cohort)

Marital status	Level of education	Field of education	Proportion of women (%)		Completed fertility		Direct component	Structural component
			1930	1970	1930	1970		
Never married	Low	General programmes	2.87	1.51	0.31	1.14	0.018	-0.010
Never married	Low	No formal schooling	0.70	0.31	0.29	1.39	0.006	-0.003
Never married	Middle	General programmes	0.26	0.36	0.28	0.43	0.000	0.000
Never married	Middle	Education	0.04	0.09	0.29	0.21	0.000	0.000
Never married	Middle	Humanities and arts	0.00	0.05	0.00	0.21	0.000	0.000
Never married	Middle	Social sciences, business and law	0.23	2.69	0.25	0.33	0.001	0.007
Never married	Middle	Science	0.00	0.14	0.00	0.30	0.000	0.000
Never married	Middle	Engineering, manufacturing and construction	0.10	1.92	0.18	0.41	0.002	0.005
Never married	Middle	Agriculture	0.01	0.30	0.00	0.45	0.001	0.001
Never married	Middle	Health and welfare	0.09	0.41	0.06	0.29	0.001	0.001
Never married	Middle	Services	0.04	1.23	0.29	0.44	0.001	0.004
Never married	Middle	Other	0.02	0.01	0.00	0.00	0.000	0.000
Never married	High	Education	0.12	0.55	0.24	0.18	0.000	0.001
Never married	High	Humanities and arts	0.08	0.95	0.07	0.20	0.001	0.001
Never married	High	Social sciences, business and law	0.11	1.73	0.11	0.21	0.001	0.003
Never married	High	Science	0.06	0.30	0.09	0.15	0.000	0.000
Never married	High	Engineering, manufacturing and construction	0.03	0.58	0.17	0.23	0.000	0.001
Never married	High	Agriculture	0.01	0.12	0.00	0.15	0.000	0.000
Never married	High	Health and welfare	0.05	0.54	0.44	0.19	-0.001	0.002
Never married	High	Services	0.02	0.27	0.00	0.22	0.000	0.000
Never married	High	Other	0.00	0.01	0.00	0.00	0.000	0.000
Ever married	Low	General programmes	65.52	15.83	2.24	2.52	0.115	**-1.183**
Ever married	Low	No formal schooling	11.85	0.22	3.25	4.42	0.070	**-0.446**

Ever married	Middle	General programmes	3.88	1.92	1.64	1.89	0.007	-0.035
Ever married	Middle	Education	0.90	0.42	1.66	1.95	0.002	-0.009
Ever married	Middle	Humanities and arts	0.09	0.32	1.56	1.78	0.000	0.004
Ever married	Middle	Social sciences, business and law	3.70	18.05	1.47	2.00	0.057	**0.249**
Ever married	Middle	Science	0.01	0.64	1.00	1.82	0.003	0.009
Ever married	Middle	Engineering, manufacturing and construction	2.57	16.28	1.60	2.14	0.051	**0.257**
Ever married	Middle	Agriculture	0.14	2.28	1.63	2.08	0.005	0.040
Ever married	Middle	Health and welfare	1.00	3.03	1.46	2.02	0.011	0.035
Ever married	Middle	Services	1.00	8.67	1.60	2.01	0.020	0.138
Ever married	Middle	Other	0.30	0.10	1.72	1.96	0.000	-0.004
Ever married	High	Education	1.28	3.06	1.53	1.83	0.006	0.030
Ever married	High	Humanities and arts	0.63	2.21	1.13	1.68	0.008	0.022
Ever married	High	Social sciences, business and law	0.84	6.00	1.14	1.74	0.020	0.074
Ever married	High	Science	0.22	0.99	1.18	1.78	0.004	0.011
Ever married	High	Engineering, manufacturing and construction	0.26	1.99	1.17	1.79	0.007	0.026
Ever married	High	Agriculture	0.17	0.71	1.37	1.70	0.001	0.008
Ever married	High	Health and welfare	0.71	2.06	1.33	1.75	0.006	0.021
Ever married	High	Services	0.07	1.14	1.00	1.69	0.004	0.014
Ever married	High	Other	0.02	0.02	0.75	1.60	0.000	0.000
		Total	*100*	*100*	*2.13*	*1.84*	*0.431*	*-0.724*

Source: own calculations based on 2011 Population Census data. Note: structural component values with smallest/largest values are bolded and shaded in red/blue.

Summing up, the share of least educated women fell sharply over the considered time span; this had a negative impact on completed fertility change because women with low education, on average, gave birth to more children.

Table 5. The most negative compositional effects within the structural component across cohorts

Cohorts	Factor combinations			Structural component values
	Marital status	Level of education	Field of education	
1930 versus 1935	Ever married	Low	No formal schooling	-0.063
1935 versus 1940	Ever married	Low	No formal schooling	-0.166
1940 versus 1945	Ever married	Low	General programmes	-0.403
1945 versus 1950	Ever married	Low	General programmes	-0.148
1950 versus 1955	Ever married	Low	General programmes	-0.144
1955 versus 1960	Ever married	Low	General programmes	-0.176
1960 versus 1965	Ever married	Low	General programmes	-0.125
1965 versus 1970	Ever married	Low	General programmes	-0.087

Source: own calculations based on 2011 Population Census data.

On the other hand, the proportion of better educated women rose considerably within the analysed period. Comparing the oldest and the youngest cohort, those women also exhibited an increase in completed fertility net of compositional changes. To gain a deeper insight on what drove the observed upward shift, let us now examine the decomposition outcomes by field of education separately for the upper level of education categories.

Table 6. Decomposition of the change in completed fertility by field of education (the oldest versus the youngest cohort)

Field of education	Middle education		High education	
	Direct component	Structural component	Direct component	Structural component
General programmes	0.017	-0.401	/	/
Education	0.001	-0.092	0.035	-0.215
Humanities and arts	0.000	0.000	0.033	-0.018
Social sciences, business and law	0.119	0.126	0.099	0.158
Science	0.004	0.016	0.027	-0.005
Engineering, manufacturing and construction	0.101	0.217	0.033	0.058
Agriculture	0.009	0.059	0.005	-0.002
Health and welfare	0.032	-0.028	0.021	-0.068
Services	0.032	0.161	0.026	0.045
Other	0.001	-0.034	0.001	-0.003
Total	*0.316*	*0.023*	*0.281*	*-0.050*

Source: own calculations based on 2011 Population Census data.

The figures obtained clearly indicate that the structural effect is largely surpassed by the direct one (Table 6). All direct component values are positive.

Among women with middle education, social sciences, business and law, engineering, manufacturing and construction are found to be study disciplines with major contributions to the rise in completed fertility. The most negative compositional effect resulted from a lower proportion of training in general programmes but was completely counterbalanced by other positive values within the structural component. Furthermore, completed fertility would have increased even more had the proportion of women with secondary school degrees in education, health and welfare remained unchanged.

As for women with high education, the most pronounced contribution to the increase in completed fertility is attributable to those who chose to specialise in social sciences, business and law. The structural component takes on a negative value, primarily due to a decreased share of women who opted for training in teaching and education science. Engineering, manufacturing and construction is again shown to be responsible for a notable fraction of an upward completed fertility change.

Finally, Table 7 sets out the results from applying conventional direct standardisation procedures aimed at assessing the role of changes in the distribution of women by field of education on completed fertility behaviour.

Table 7. Actual and directly standardised completed fertility: women with middle and high education

Cohort	Middle education		High education	
	Actual completed fertility	Standardised completed fertility	Actual completed fertility	Standardised completed fertility
1930	1.50	1.50	1.18	1.18
1935	1.53	1.53	1.35	1.33
1940	1.60	1.60	1.44	1.43
1945	1.71	1.71	1.58	1.57
1950	1.75	1.73	1.54	1.56
1955	1.80	1.78	1.56	1.58
1960	1.89	1.84	1.61	1.61
1965	1.92	1.86	1.54	1.55
1970	1.84	1.77	1.41	1.44

Source: own calculations based on 2011 Population Census data. Note: the distribution of women born in 1930 by field of education is used as the standard population.

Assuming a constant structure of female population by study discipline across cohorts, completed fertility of middle educated women would have not increased. On the contrary, it would have dropped slightly. Unexpectedly, completed fertility among highly educated women would have remained virtually unchanged if the distribution of female population by study discipline had stayed the same.

4.3. Parity progression ratios

Our results clearly indicate an overall completed fertility decline over the observed cohort range. Investigating cohort parity progression ratios yields a deeper understanding of the educational gradient in childbearing by birth order within the analysed time span.

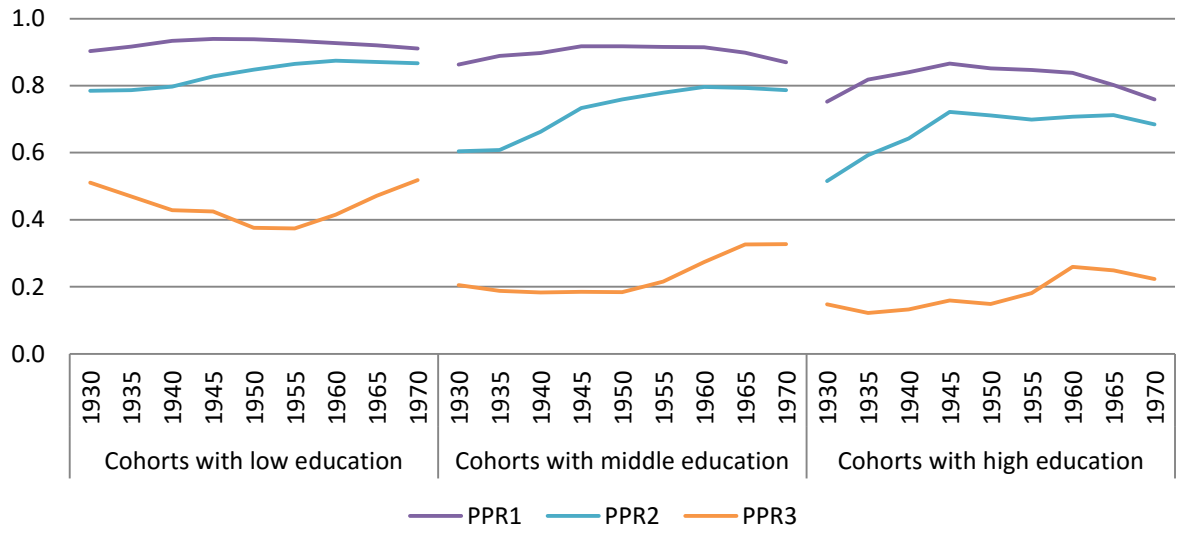
In general, the proportion of women who became mothers is quite high for the majority of considered cohorts (Figure 4). The largest probabilities of having a first child (amounting to over 90%)

are, unsurprisingly, exhibited by women with low education but are closely followed by values referring to women with middle education. Even women with high education show a relatively high probability of having a first child and lag behind women with low education by less than 10 percentage points.

Progression to second births shows the largest educational differential within the oldest cohort. Its level gradually rose, with more pronounced increases visible among better educated women. While only about 50% of women with high education within the oldest cohort had a second child, the corresponding figure went up to over 70% within the 1945 cohort and then it levelled off.

Among women with low education, progression to higher order births is mildly u-shaped and reaches its minimum within the 1955 cohort. Only 20% of middle educated women born before 1950 gave birth to a third child. However, progression to third births thereafter began to rise, surpassing 30% within the youngest cohort. Progression ratios to parity three also show an upward tendency among women with high education and achieve values of over 20% within younger cohorts (1960, 1965, 1970).

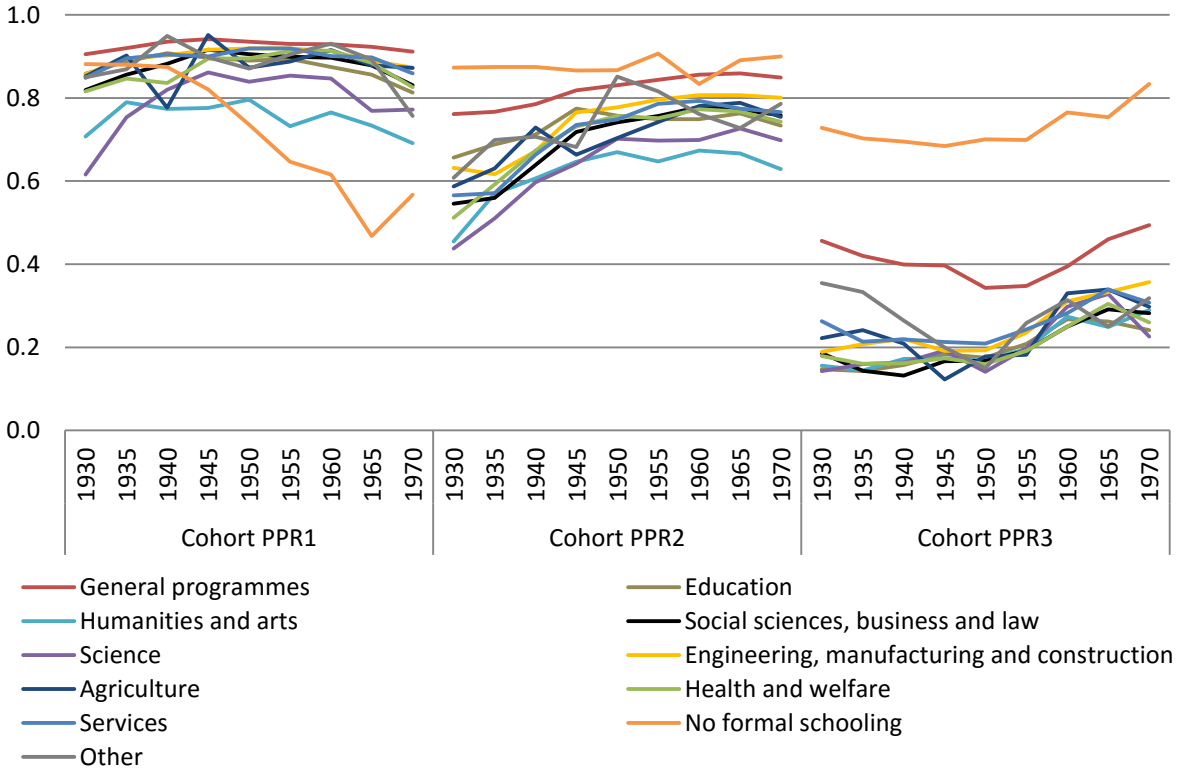
Figure 4. Cohort parity progression ratios by level of education



Source: own calculations based on 2011 Population Census data.

When considering cohort parity progression ratios by field of education (Figure 5), a different pattern emerges. Recognising women with no formal education and women with general programme schooling as outliers, we find no substantial variation in cohort parity progression ratios among women who obtained training in particular disciplines. On the contrary, cohort parity progression ratios by field of education are closely in line with the corresponding values referring to order-specific fertility behaviour by level of education. Women educated in science, humanities and arts may be, however, regarded as exceptions as they exhibited a somewhat lower progression to first and second births throughout the observed period.

Figure 5. Cohort parity progression ratios by field of education



Source: own calculations based on 2011 Population Census data.

5. CONCLUSION

Popular explanations of aggregate fertility decline oftentimes link changes in childbearing outcomes to women's educational expansion. The results presented in this paper once again confirm the presence of such a relationship. We find that a decrease in completed fertility among Croatian women born between 1930 and 1970 is hugely attributable to improvements in female educational structure. Had the distribution of women by level of education remained constant, completed fertility would not have dropped; it would have stayed at or above the replacement level. This comes as no surprise within low fertility settings, especially among former socialist countries in Central and Eastern Europe (Brzozowska, 2014, 2015).

One of the aims of this paper was to investigate how educational differentials in completed fertility changed during the socialist and early post-socialist period in Croatia. Among cohorts of the 1930s, women at the lower end of the educational spectrum represented a large majority. A significant rise in the proportion of better educated women began among cohorts of shortly after the World War II. The share of middle educated women exhibited a faster rise as compared to the share of highly educated women. The size of female population with middle education surpassed the size of female population with low education among cohorts of the 1950s. The fraction of least educated women continued to decline and, by the end of the observation period, it became the smallest distributional category.

Completed fertility among women with low education remained quite stable throughout the analysed cohort range. On the other hand, completed fertility among women with middle and high education exhibited an overall increase. Educational differentials in completed fertility initially

showed some signs of convergence but once again started to widen among cohorts of the 1960s. Women who gave birth in the late 1960s and during the 1970s, when Yugoslavia experienced positive economic growth (Sirotković, 1996), exhibited more homogeneity in completed fertility by level of education. On the other hand, women who gave birth during the 1990s, when Croatia declared independence and faced a major economic downturn, exhibited notably larger educational differentials in completed fertility. These findings are in agreement with contemporary research evidence on the association between reproductive behaviour and economic environment (Sobotka, Skirbekk and Philipov, 2011).

The results of our decomposition analyses reveal the dominance of the structural effect in explaining the overall completed fertility decline in Croatia. The same conclusion applies to other post-socialist countries in Central and Eastern Europe (Brzozowska, 2015). Married women with low education are shown to be the largest contributors to a downward shift in childbearing outcomes. Field of education was also introduced as a possible source of completed fertility differentials. We assumed that the changing distribution of women by field of education at least partially accounts for the observed patterns in completed fertility but found no strong evidence in support of the outlined hypothesis. A stable distribution of better educated women by field of education would have led to at best modest changes in completed fertility. One can speculate that field of education plays a minor role in the overall completed fertility change during the earlier stages of the educational expansion. Under such circumstances, the effect of choosing a particular study discipline appears to be completely counterbalanced by the influence of a shrinking proportion of women with least education.

REFERENCES

Akrap, A. (2004). Zapošljavanje u inozemstvu i prirodna depopulacija seoskih naselja. *Društvena istraživanja* 13(4–5): 675–699.

Bagavos, C. (2010). Education and childlessness: The relationship between educational field, educational level, employment and childlessness among Greek women born in 1955-1959. *Vienna Yearbook of Population Research* 8: 51-75.

Balbo, N., Billari, F. C. and M. Mills (2013). Fertility in advanced societies: a review of research. *European Journal of Population* 29(1): 1–38.

Begall, K. and M. Mills (2013). The Influence of Educational Field, Occupation, and Occupational Sex Segregation on Fertility in the Netherlands. *European Sociological Review* 29(4): 720–42.

Blossfeld, H.-P. and J. Huinink (1991). Human capital investments or norms of role transition? How women's schooling and career affect the process of family formation. *The American Journal of Sociology* 97(1): 143–168.

Brewster, K.L. and R.R. Rindfuss (2000). Fertility and women's employment in industrialized nations. *Annual Review of Sociology* 26: 271–296.

Breznik, D. (1991). *Stanovništvo Jugoslavije*. Titograd: Chronos, Konzorcijum instituta društvenih nauka.

Breznik, D., Mojić, A., Rašević, M. and Rančić, M. (1972). *Fertilitet stanovništva u Jugoslaviji*. Beograd: Institut društvenih nauka, Centar za demografska istraživanja.

Brzozowska, Z. (2014). Fertility and education in Poland during state socialism. *Demographic Research* 31(12): 319–336.

Brzozowska, (2015).Female education and Fertility under State Socialism in Central and Eastern Europe. *Population* 4(70): 731–769.

Canudas Romo, V. (2003). *Decomposition Methods in Demography*. Groningen: Rijksuniversiteit Groningen.

Carmichael, G. A. (2016). *Fundamentals of Demographic Analysis: Concepts, Measures and Methods*. Cham: Springer International Publishing.

CBS (2016a). Women and Men in Croatia, 2016. Zagreb: Croatian Bureau of Statistics. http://www.dzs.hr/Hrv_Eng/menandwomen/men_and_women_2016.pdf (1 August 2016)

CBS (2016b). *Census of Population, Households and Dwellings 2011*. Zagreb: Croatian Bureau of Statistics. http://www.dzs.hr/Eng/censuses/census2011/censuslogo.htm (1 August 2016)

Cho, L. J. and R. D. Retherford (1973). Comparative analysis of recent fertility trends in East Asia. In: International Union for the Scientific Study of Population (Eds.). *Proceedings of the 17th General Conference of the IUSSP*. Liège, Belgium: IUSSP, 163–181.

Cohen, J. E., Kravdal, Ø. and N. Keilman (2011). Childbearing impeded education more than education impeded childbearing among Norwegian women. *Proceedings of the National Academy of Sciences of the United States of America* 108(29): 11830–11835.

Das Gupta, P. (1978). A General Method of Decomposing a Difference between Two Rates into Several Components. *Demography* 15(1): 99–112.

Feeney, G. (1991). Fertility decline in Taiwan: A study using parity progression ratios. *Demography* 28(3): 467–479.

Frejka, T. and J.-P. Sardon (2007). Cohort birth order, parity progression ratio and parity distribution trends in developed countries. *Demographic Research* 16(11): 315–374.

Hoem, J. M. (1986.) The impact of education on modern family-union initiation. *European Journal of Population* 2(2): 113-133.

Hoem, J.M., G. Neyer and G. Andersson (2006a). Education and childlessness: The relationship between educational field, educational level, and childlessness among Swedish women born in 1955-59. *Demographic Research* 14(15): 331–380.

Hoem, J.M., G. Neyer and G. Andersson (2006b). Educational attainment and ultimate fertility among Swedish women born in 1955-59. *Demographic Research* 14(16): 381–404.

Kitagawa, E. M. (1955). Components of a difference between two rates. *Journal of the American Statistical Association* 50(272): 1168–1194.

Kerovec, N. (2003). (Ne)jednakost žena na tržištu rada. *Revija za socijalnu politiku* 10(3): 263–282.

Kohler, H.-P. and A. Ortega (2002). Tempo-Adjusted Period Parity Progression Measures, Fertility Postponement and Completed Cohort Fertility. *Demographic Research* 6(6): 91–144.

Kravdal, Ø. and R. R. Rindfuss (2008). Changing Relationships between Education and Fertility: A Study of Women and Men Born 1940 to 1964. *American Sociological Review* 73(5): 854–873.

Lappegård, T. and M. Rønsen (2005). The multifaceted impact of education on entry into motherhood. *European Journal of Population* 21(1): 31-49.

Lesthaeghe, R. (1995). The second demographic transition in Western countries: an interpretation. In: K.O. Mason and A.-M. Jensen (Eds.). *Gender and family change in industrialized countries* (pp. 17–62). Oxford, England: Clarendon Press.

Liefbroer, A.C. and M. Corijn (1999). Who, what, where and when? Specifying the impact of educational attainment and labour force participation on family formation. *European Journal of Population* 15(1): 45–75.

Martín-García, T. (2008). A reassessment of the role of women's education in existing fertility research. *Genus* LXIV(1-2): 131–157

Martín-García, T. and P. Baizán (2006). The impact of the type of education and of educational enrolment on first births. *European Sociological Review* 22(3): 259–275.

McDonald, and Kippen, (2009). Fertility in South Australia: An overview of trends and socio-economic differences. *Report to the Department of Trade and Economic Development*. Adelaide: Government of South Australia.

Michelmore, K., and Musick, K. (2013). Fertility Patterns of College Graduates by Field of Study, US Women Born 1960-79. *Population Studies* 68(3): 359–374.

Neyer, G. and J. M. Hoem (2008). Education and permanent childlessness: Austria vs. Sweden; a research note. In: J. Surkyn, P. Deboosere and J. Van Bavel (Eds.). A tribute to the continuing endeavours of Prof. Dr. Em. Ron Lesthaeghe in the field of demography (pp. 91–112). Brussels: Brussels University Press.

Prpić, K. (1979). Žena u procesu zapošljavanja. *Sociologija sela* 63–64: 49–59.

Rašević, M. (1971). *Determinante fertiliteta stanovništva u Jugoslaviji*. Beograd: Institut društvenih nauka – Centar za demografska istraživanja.

Rønsen, M., and K. Skrede (2010). Can public policies sustain fertility in the Nordic countries? Lessons from the past and questions for the future. *Demographic Research* 22(13): 321– 346.

Sirotković, J. (1996). *Hrvatsko gospodarstvo – privredna kretanja i ekonomska politika*. Zagreb: Golden Marketing – Tehnička knjiga i HAZU.

Skirbekk, V. (2008). Fertility trends by social status. *Demographic Research* 18(5): 145–180.

Sobotka, T., Skirbekk, V. and D. Philipov (2011). Economic Recession and Fertility in the Developed World. *Population and Development Review* 37(2): 267–306.

Tesching, K. (2012). *Education and Fertility: Dynamic Interrelations Between Women's Educational Level, Educational Field and Fertility in Sweden*. Stockholm: Acta Universitatis Stockholmiensis.

Tomić-Koludrović, I. and M. Petrić (2007). Hrvatsko društvo – prije i tijekom tranzicije. *Društvena istraživanja* 4–5(90–91): 867–889.

Neyer, G. and J.M. Hoem (2008). Education and permanent childlessness: Austria vs. Sweden; a research note. In: J. Surkyn, P. Deboosere and J. van Bavel (Eds.). A tribute to the continuing endeavours of Prof. Dr. Em. Ron Lesthaeghe in the field of demography (pp. 91–112). Brussels, Brussels University Press.

Wertheimer-Baletić, A. (1971). *Stanovništvo SR Hrvatske – studije*. Zagreb: Školska knjiga.

Woodward, S. (1995). *Socialist Unemployment: The Political Economy of Yugoslavia 1945 – 1990*. Princeton: Princeton University Press.