DEMOGRAPHIC RESEARCH
A peer-reviewed, open-access journal of population sciences

DEMOGRAPHIC RESEARCH

VOLUME 54, ARTICLE 19, PAGES 577–590
PUBLISHED 25 MARCH 2026
https://www.demographic-research.org/Volumes/Vol54/19/
DOI: 10.4054/DemRes.2026.54.19

Descriptive Finding

Between two worlds: Cohort fertility dynamics before, during, and after the transition to a market economy in Hungary – A decomposition analysis

Laura Szabó

Zsuzsanna Makay

Contents

1	Introduction	578
2	Contextual background: Changes in education and fertility behaviour	578
3	Research objective	580
4	Methodology	580
4.1	Source of data and the target group	580
4.2	Variables and statistical analysis	581
5	Results	582
6	Conclusion	586
7	Acknowledgements	587
	References	588

Demographic Research: Volume 54, Article 19
Descriptive Finding

Between two worlds: Cohort fertility dynamics before, during, and after the transition to a market economy in Hungary – A decomposition analysis

Laura Szabó[1]

Zsuzsanna Makay[2]

Abstract

BACKGROUND
The collapse of state socialism and Hungary's transition to a market economy after 1989 greatly changed societal structures, including patterns of fertility and education.

OBJECTIVE
This study examines whether changes in the completed cohort fertility rate (CFR) among Hungarian women born between 1920 and 1982 resulted from shifts in educational composition or fertility within educational groups.

METHODS
Using Kitagawa's decomposition method, we split CFR change into structural and behavioural effects. We compare female birth cohorts whose main childbearing occurred during the pre-transition, transition, and post-transition periods of the socialist regime change, relying on data from six full Hungarian censuses (1970–2022).

RESULTS
Structural effects dominated in the pre-transition cohort, behavioural effects in the post-transition cohort, while both were small and offsetting in the transition cohort (1960–1969). In all cohorts, women with primary education made the largest overall contribution to CFR change, mainly due to their declining population share. Parity patterns also shifted, as lower childlessness and higher second-birth rates supported CFR in the pre-transition cohort, whereas rising childlessness and declining second births reduced CFR in the post-transition cohort.

[1] Senior Research Fellow at HCSO Institute for Quantitative Population and Economic Research, Hungarian Demographic Research Institute, Budapest, Hungary. Email: szabo@demografia.hu.
[2] Senior Research Fellow at HCSO Institute for Quantitative Population and Economic Research, Hungarian Demographic Research Institute, Budapest, Hungary. Email: makay@demografia.hu.

CONCLUSION
Overall, fertility change in Hungary shifted from structural to behavioural drivers, with women born in 1960–1969 displaying a transitional pattern that supports their classification as a transition cohort.

CONTRIBUTION
Using a cohort perspective, the paper shows how changes in the education–fertility relationship reflect a shift from structural to behavioural drivers of fertility decline.

1. Introduction

Several studies have analysed the relationship between education and cohort fertility in Central and Eastern Europe (CEE), most focusing on the socialist period. They show that educational expansion contributed to fertility decline, reinforced negative educational gradients in childbearing, and influenced the number and timing of children across cohorts (Zeman 2018; Brzozowska 2014, 2015; Wood, Neels, and Kil 2014). Our analysis aims to contribute to existing studies in CEE by examining the relationship between education and fertility in Hungary. Taking advantage of the time elapsed since the political regime change and the 2022 Hungarian census, we compare the role of education and parity-specific fertility in shaping fertility change during socialism, the transition period, and after 1989.

2. Contextual background: Changes in education and fertility behaviour

Since the 1950s, Hungary has experienced significant educational expansion, establishing a common eight-year school for all children, increasing pre-school provision, extending full-time secondary education to 45% of pupils, and rapidly expanding higher education (Richmond 1966). The share of pupils continuing to secondary education rose from 80% in 1970 to 93.4% in 1990, while participation in higher education increased from 4.1% to 10.4% over the same period (KSH 1991). Despite these changes, fertility behaviour remained relatively homogeneous during this period. Early marriage and childbearing were widespread, and childlessness was relatively low, with few differences across educational groups; moreover, it declined sharply among women born between 1935 and 1959 (Table 1). Most young people followed the ‘classical’ pathway into

adulthood, characterised by early and near-universal marriage and rapid transition to parenthood (Spéder and Kamarás 2008).

Educational expansion continued after the 1989 regime change, particularly in higher education, with around half of 20-year-olds enrolled full time (KSH 1991). Consequently, the educational composition of women changed fundamentally across birth cohorts (Table 1). The political regime change in 1989 also marked a turning point in fertility behaviour, as the postponement of childbirth became increasingly associated with rising levels of education (Spéder 2019). Fertility became more strongly differentiated by educational attainment, with higher education linked to lower fertility levels (Spéder and Kamarás 2008). At the same time, childbearing patterns became more closely tied to individuals' social position than in earlier decades. Early and relatively high fertility remained characteristic of women with low education, whereas higher educated groups increasingly postponed entry into parenthood (Spéder et al. 2002; Spéder 2019). This resulted in important parity differences, with childlessness about twice as prevalent among women with secondary or tertiary education as among those with only primary education (Szabó 2020). Parity distributions also varied by education: Although the share of women with three or more children declined over time, it remained the highest among women with primary education (Table 1).

Table 1: The distribution of women aged 40–70 born in 1920–1982 by their highest educational attainment and parity, %

Birth cohort	Educational levels	N total	Educational distribution of the cohort (%)	Parity distribution by education(row %)			
				Parity0 (%)	Parity1 (%)	Parity2 (%)	Parity3+ (%)
1920–1934	Total	773,409	100.0	12.8	24.9	35.2	27.1
	Primary	684,426	88.5	11.6	23.8	35.4	29.2
	Vocational	-	-	-	-	-	-
	Secondary	65,385	8.5	20.6	33.9	34.1	11.4
	Tertiary	23,599	3.1	23.9	31.1	12.4	10.6
1935–1959	Total	1,108,950	100.0	8.4	23.2	49.5	19.0
	Primary	525,820	47.4	6.8	20.4	46.7	26.1
	Vocational	113,582	10.2	5.2	20.6	56.1	18.1
	Secondary	325,226	29.3	9.7	27.5	51.8	11.0
	Tertiary	144,322	13.0	13.6	25.7	21.8	11.6
1960–1969	Total	526,904	100.0	9.6	22.8	45.7	22.0
	Primary	104,315	19.8	10.1	15.6	35.1	39.2
	Vocational	124,833	23.7	6.6	21.7	49.5	22.2
	Secondary	180,665	34.3	9.2	26.4	48.9	15.5
	Tertiary	117,091	22.2	12.8	24.7	29.9	16.3
1970–1982	Total	669,823	100.0	16.9	28.2	35.8	19.1
	Primary	88,753	13.3	14.6	19.7	26.0	39.7
	Vocational	142,718	21.3	12.5	29.6	37.2	20.7
	Secondary	230,041	34.3	16.9	31.8	37.3	13.9
	Tertiary	208,312	31.1	20.7	27.0	33.8	15.0

Source: Population census 1970, 1980, 1990, 2001, 2011, 2022, Hungary.

3. Research objective

This study examines how changes in educational composition and education-specific fertility shaped cohort fertility change among Hungarian women born between 1920 and 1982. Using decomposition techniques, it distinguishes structural (indirect) from behavioural (direct) components of CFR change, identifies the educational and parity-specific sources of these changes, and evaluates whether the balance between structural and behavioural drivers shifted across cohorts, particularly for women born in 1960–1969 as a potential transition cohort. To better understand the sources of CFR change identified by the direct–indirect decomposition, we further decompose the CFR change by educational attainment to identify which groups contribute most to overall change, and by parity (including childlessness) to reveal the childbearing behaviours underlying the behavioural component.

4. Methodology

4.1 Source of data and the target group

Our analysis is based on data from the six most recent individual-level full population censuses, conducted in 1970, 1980, 1990, 2001, 2011, and 2022. For each census year, we selected five variables: sex, year of birth, age, educational attainment, and number of live-born biological children. We then appended the census datasets and selected female birth cohorts aged 40–70 in a given census year, born between 1920 and 1982. Next, we used data from the Human Fertility Database (HFD) to determine the women's main childbearing years, across three periods in Hungary: state socialism, the transition years, and the transition to a market economy.

To define the main childbearing years, we explored the birth patterns for each cohort by recording the number of children born at each maternal age. We then calculated the cumulative distribution of births and identified the key percentiles (25^{th}, 50^{th}, and 75^{th}) to determine the periods during which the majority of births occurred for each cohort. By focusing on the second and third quartiles of the birth distribution, we established a proxy for the core childbearing years within each cohort. The results show that for almost every cohort 50% of childbirths fall within a seven-year period, primarily between the ages of 21 and 28 for women born in 1935–1947. This pattern evolved over time and later cohorts demonstrated clear postponement of childbirth.

Based on these calculations from HFD, we classified cohorts into three distinct groups: women born in 1935–1959 had their children before the transition: 75^{th} percentile of their births fell before 1987. It is reasonable to date the onset of Hungary's transition

to 1987–1988, rather than only to the formal institutional changes of 1989–1990, as several of the political forces that would later become dominant parliamentary parties had already been founded by 1987, and the process even accelerated in 1988, when on March 15 mass demonstrations openly demanded democratic representation and political freedoms from the state (Ripp 2006). Women born in 1960–1969 experienced their main childbearing years during the transition period, between 1987 and 1998 (Hungary was nearing the completion of its market transition in 1998, Buss 2000). Finally, women born in 1970–1982 had their children mainly after the transition period.

As the HFD does not contain complete data on parity by maternal age between 40 and 70 for women born in 1920–1934, this group is not classified as part of the pre-transition cohort. For the purposes of our analysis, however, we will focus on this birth cohort, since it will serve as the reference group in the decomposition analysis for those born in 1935–1959.

4.2 Variables and statistical analysis

The variables used in decomposition analysis were the number of live-born children recorded from all women aged 40 to 70 in all censuses, as well as the highest educational attainment of these women. There were no missing data in these variables. To decompose the change in CFR, we calculated the mean number of children and women by aggregating individual-level data by birth cohort, educational level, and parity from the appended database of six censuses. For this step, we employed the four groups of birth cohorts (1920–1934, 1935–1959, 1960–1969, 1970–1982), a four-category version of educational attainment (primary education: equivalent to ISCED 1997–0, 1, 2; vocational education: ISCED 1997–3C; secondary education: ISCED 1997–3A, B, 4; tertiary education: ISCED 1997–5, 6; KSH 2024) and a four-category version of parity (childless, parity 1, parity 2, and parity 3+). The completed cohort fertility rate (CFR) is the average number of children of women aged 40 to 70 calculated by dividing the total number of live births by the total number of women in each birth cohort (Eijkemans et al. 2014; Leridon 2008).

The change in women's completed fertility can be decomposed into structural (1) and behavioural or direct (2) components. We decompose the change in the overall CFR based on the variation in the educational composition of cohorts, and the education-specific CFR. The direct component can be further decomposed into the effects of childlessness (2a) and of different parities (2b). We used the symmetrical Kitagawa decomposition method, which involves equally dividing the interaction term between the direct and structural components (Kitagawa 1955). The decomposition follows the next formula, where t is the birth cohort, $p(t)i$ is the share of i educated women among women,

m(t)i is the proportion of *i* educated mothers among *i* educated women, *MCFR(t)ji* is the average number of children of mothers with *i* education and *j* parity, Δ*CFR(t+1, t)* is the difference between CFR(t+1) and CFR(t). The change of CFR is thus always against the previous cohort.

ΔCFR(t+1, t) =

$$\sum_{i=1}^{4}\sum_{j=1}^{4}[(p(t+1)i - p(t)i) * \frac{m(t+1)i + m(t)i}{2} * \frac{(MCFR(t+1)ji + MCFR(t)ji}{2}] \quad + \quad (1)$$

$$\sum_{i=1}^{4}\sum_{j=1}^{4}[(m(t+1)i - m(t)i) * \frac{p(t+1)i + p(t)i}{2} * \frac{(MCFR(t+1)ji + MCFR(t)ji}{2}] \quad + \quad (2a)$$

$$\sum_{i=1}^{4}\sum_{j=1}^{4}[(MCFR(t+1)ji - MCFR(t)ji) * \frac{p(t+1)i + p(t)i}{2} * \frac{m(t+1)i + m(t)i}{2}] \quad (2b)$$

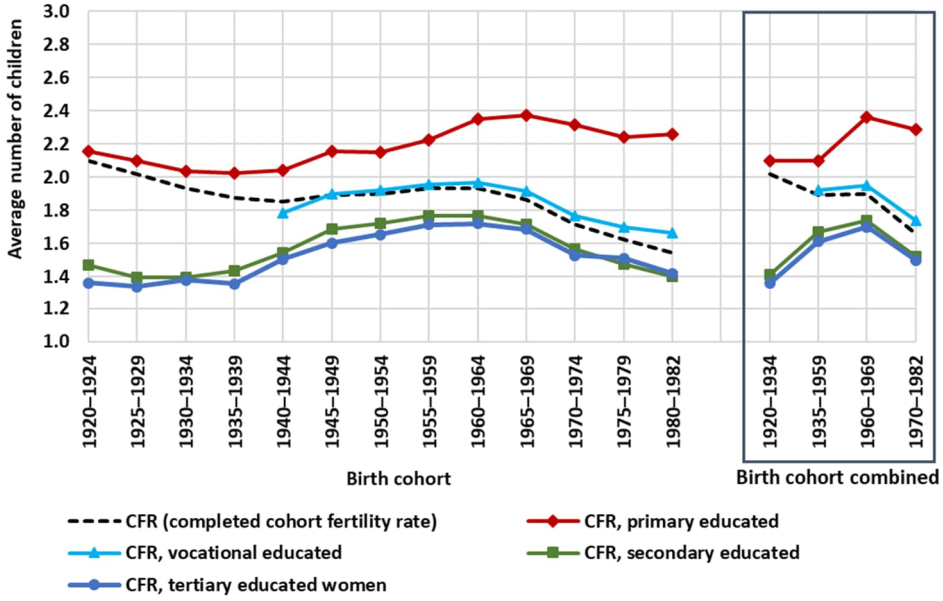
To obtain the decomposition by educational attainment, we summed the education-specific components of the change in CFR across all parity categories; to obtain the decomposition by parity (including childlessness), we summed the parity-specific components across all educational groups.

The analysis was processed by Excel Microsoft Office Professional Plus 2016.

5. Results

The CFR declined from 2.02 among women born in 1920–1934 to 1.66 among those born in 1970–1982 (Figure 1). Across all cohorts, primary-educated women consistently had the highest CFR, while tertiary-educated women had the lowest. Educational differences in CFR converged up to the 1935–1959 cohort but diverged among later cohorts.

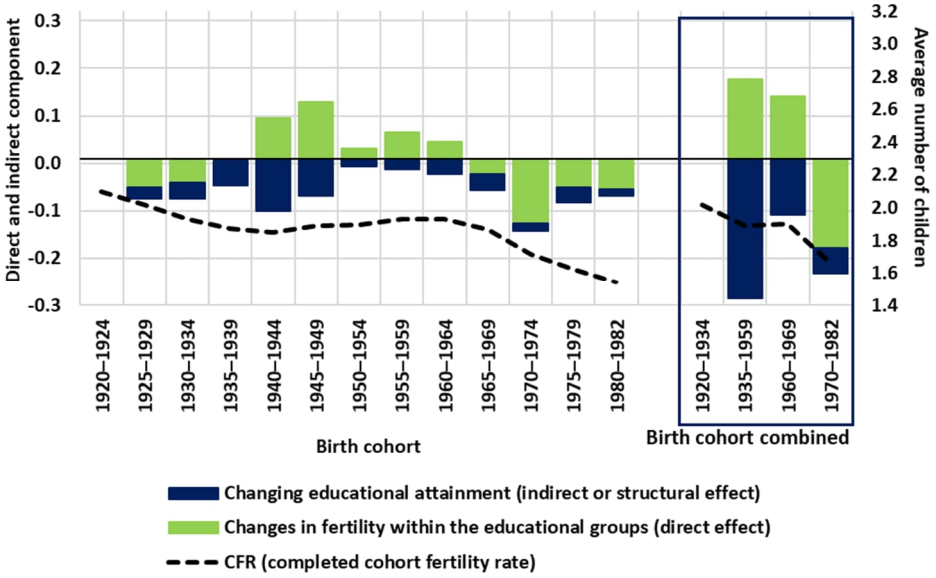
Figure 1: Change in the CFR by educational groups, for women aged 40–70 born in 1920–1982



Source: Population census 1970, 1980, 1990, 2001, 2011, 2022, Hungary.
Note: Changes among the five-year cohorts are shown only to illustrate the degree of homogeneity or heterogeneity within the pre-transition (1935–1959), transition (1960–1969), and post-transition (1970–1982) cohorts. By the time women born between 1970 and 1982 reach 50 years of age, their completed CFR may be slightly higher than that presented here.

The direct–indirect decomposition (Figure 2) shows that rising educational attainment contributed negatively to CFR change in all cohorts, with the strongest effect in the pre-transition cohort (1935–1959). In contrast, changes in fertility within educational groups contributed positively to CFR change in the pre-transition and transition cohorts, but negatively in the post-transition cohort (1970–1982). In the pre-transition cohort, the structural effect was larger in absolute terms than the direct effect (−0.29 vs. 0.17), whereas in the post-transition cohort the direct effect dominated (−0.19 vs. −0.05). For women born in 1960–1969, the two effects were small and largely offsetting (−0.12 and 0.13), supporting the interpretation of this cohort as transitional.

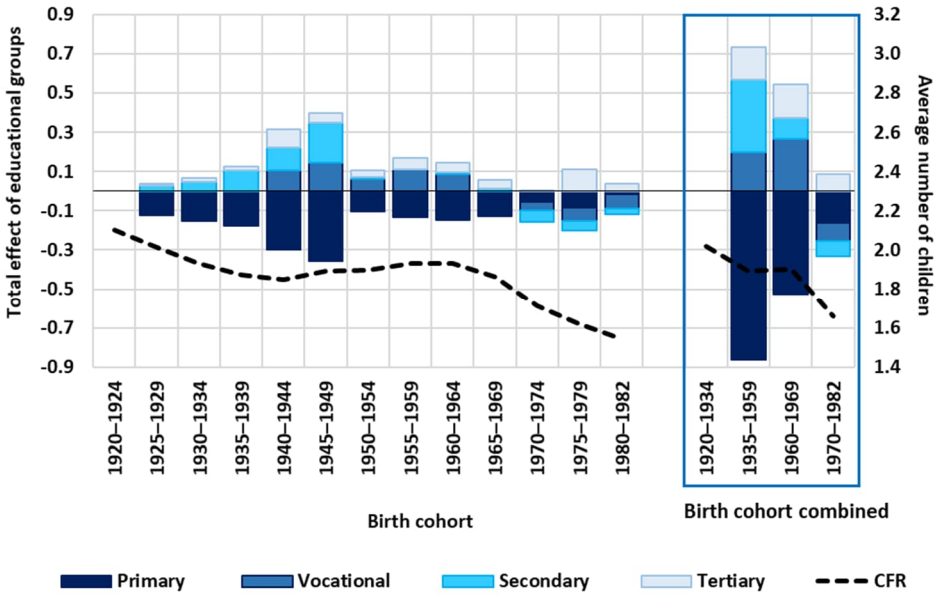
Figure 2: CFR and decomposition of its change into direct and indirect (structural) components, for women aged 40–70 born in 1920–1982



Source: Population census 1970, 1980, 1990, 2001, 2011, 2022, Hungary.
Note: Changes among the five-year cohorts are shown only to illustrate the degree of homogeneity or heterogeneity within the pre-transition (1935–1959), transition (1960–1969), and post-transition (1970–1982) cohorts. The change of CFR is always against the previous cohort.

The second decomposition (Figure 3) shows how educational groups contribute to overall CFR change. Primary education made the largest negative contribution in all cohorts (−0.86 in 1935–1959, −0.53 in 1960–1969, and −0.16 in 1970–1982), reflecting the shrinking share of primary-educated women rather than declining fertility within this group. In the 1960–1969 cohort, this negative contribution was almost fully offset by positive contributions from vocational, secondary, and tertiary education, so that the opposing effects largely cancelled out and education as a whole had little impact on CFR change. In the pre-transition cohort, the positive contributions of other education groups were much smaller than the negative effect of primary education. In the post-transition cohort vocational and secondary education also contributed negatively and only tertiary education remained slightly positive.

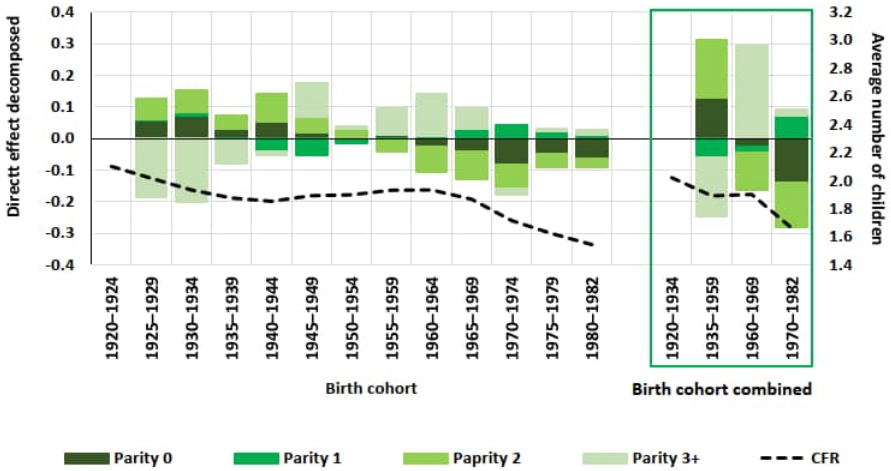
Figure 3: The role of each educational group in the change of overall CFR for women aged 40–70 born in 1920–1982



Source: Population census 1970, 1980, 1990, 2001, 2011, 2022, Hungary.
Note: Changes among the five-year cohorts are shown only to illustrate the degree of homogeneity or heterogeneity within the pre-transition (1935–1959), transition (1960–1969), and post-transition (1970–1982) cohorts. The change of CFR is always against the previous cohort.

The third, parity-specific decomposition shows clear cohort differences in the components of CFR change (Figure 4). In the pre-transition cohort (1935–1959), lower childlessness increased CFR (+0.13), while in the transition cohort (1960–1969) its effect was negligible (−0.03), indicating an intermediate pattern. In the post-transition cohort (1970–1982), rising childlessness became a major contributor to fertility decline (−0.14), alongside declining second births (−0.15), while the positive contribution of third and higher-order births weakened substantially (+0.02). Taken together, these findings indicate that women born in 1960–1969 represent a turning point in family-size dynamics, after which fertility decline in younger cohorts was increasingly driven by rising childlessness and declining progression to second births.

Figure 4: Decomposition of the direct effect by number of children for women aged 40–70 born in 1920–1982



Source: Population census 1970, 1980, 1990, 2001, 2011, 2022, Hungary.
Note: Changes among the five-year cohorts are shown only to illustrate the degree of homogeneity or heterogeneity within the pre-transition (1935–1959), transition (1960–1969), and post-transition (1970–1982) cohorts. The change of CFR is always against the previous cohort.

6. Conclusion

The direct–indirect decomposition provides the main analytical framework by separating changes in completed cohort fertility (CFR) into a structural component, reflecting shifts in women's educational composition, and a direct (behavioural) component, reflecting changes in education-specific fertility. Building on this framework, the decomposition by educational attainment allocates the overall change in CFR – combining both structural and behavioural components – across educational groups, thereby identifying which groups contribute most to fertility change. In contrast, the parity-based decomposition, including childlessness, focuses exclusively on the behavioural dimension by disaggregating CFR change into contributions from different birth orders, revealing how changes in fertility behaviour (entry into parenthood and progression to higher parities) shape cohort fertility. Together, these complementary decompositions allow CFR change to be examined in terms of type of process (structural vs. behavioural), contributing groups (education), and underlying fertility behaviour (parity).

The decomposition analyses show that the drivers of CFR decline in Hungary shifted from structural change in educational composition to fertility behaviour within educational groups. Across three broad birth cohorts (1935–1959, 1960–1969, and 1970–1982), CFR declined alongside rising educational attainment, with the results indicating associations without implying causal relationships.

The direct–indirect decomposition indicates that structural effects dominated CFR decline in the pre-transition cohort, while behavioural effects became dominant in the post-transition cohort; in contrast, both components were small and partly offsetting for women born in 1960–1969.

The decomposition by educational level shows that primary education made the largest contribution to CFR change in all cohorts, not because fertility among primary-educated women declined, but because their shrinking population share reduced overall CFR, with this contribution being strongest before the transition and weakening thereafter.

The parity-based decomposition shows that lower childlessness increased CFR in the pre-transition cohort, whereas rising childlessness and declining second births reduced CFR in the post-transition cohort. In the 1960–1969 cohort, third and higher-order births made the largest positive contribution to CFR change, but this was largely offset by declining second births, resulting in a moderate net parity effect on CFR change.

Overall, the consistent pattern across all three decompositions suggests that the 1960–1969 cohort represents a transition between structurally and behaviourally driven fertility change.

This study is limited by its reliance on census data, which restricts our ability to capture changes in values and aspirations, or include qualitative aspects related to reproductive decision-making.

7. Acknowledgements

We thank the Methodology Department of the Hungarian Central Statistical Office for providing access to full population-level census data in a secure research environment. We are also grateful to the anonymous reviewers of Demographic Research for their constructive comments.

Laura Szabó: Conceptualization, Data curation, Formal Analysis, Methodology, Software, Supervision, Validation, Visualization, Writing – original draft, and Writing – review and editing.

Zsuzsanna Makay: Conceptualization, Formal Analysis, Methodology, Validation, Writing – original draft, and Writing – review.

References

Brzozowska, Z. (2014). Fertility and education in Poland during state socialism. *Demographic Research* 31(12): 319–336. doi:10.4054/DemRes.2014.31.12.

Brzozowska, Z. (2015). Female education and fertility under state socialism in Central and Eastern Europe. *Population* 70(4): 689–725.

Buss, T.F. (2000). Economic development in Hungary: The transition years – 1989 to 1998. *International Journal of Economic Development* 2(1): 12–35.

Eijkemans, M.J.C., van Poppel, F., Habbema, D.F., Smith, K.R., Leridon, H., and te Velde, E.R. (2014). Too old to have children? Lessons from natural fertility populations. *Human Reproduction* 29(6): 1304–1312. doi:10.1093/humrep/deu056.

HFD (2025). Human Fertility Database. Rostock and Vienna: Max Planck Institute for Demographic Research and Vienna Institute of Demography. www.humanfertility.org. (data downloaded on 04.06.2025).

Kitagawa, E.M. (1955). Components of a difference between two rates. *Journal of the American Statistical Association* 50(272): 1168–1194. doi:10.1080/01621459.1955.10501299.

KSH (1991). Magyar Statisztikai Évkönyv, KSH, 1990. https://adt.arcanum.com/hu/view/MagyarStatisztikaiEvkonyv_1990/?pg=58&layout=s.

KSH (2024). Educational attainment - Population and Housing Population and Housing Census. Metainformation. https://www.ksh.hu/apps/meta.objektum?p_lang=EN&p_menu_id=110&p_ot_id=100&p_obj_id=ACAA.

Leridon, H. (2008). A new estimate of permanent sterility by age: Sterility defined as the inability to conceive. *Population Studies* 62(1): 15–24. doi:10.1080/00324720701804207.

Richmond, W.K. (1966). Educational planning in Hungary. *Comparative Education* 2(2): 93–105. doi:10.1080/0305006660020203.

Ripp, Z. (2006). *System change in Hungary, 1987–1990*. Budapest: Napvilág Kiadó.

Spéder, Zs. (2019). Domestic fertility behavior in international comparison. Doctoral thesis. Budapest: Hungarian Academy of Sciences.

Spéder, Zs., Elekes, Z., Harcsa, I., and Róbert, P. (2002). Hungary: The outlines of the transformation. In: Adamski, W., Machonin, P., and Zapf, W. (eds.). *Structural change and modernisation in post-socialist societies*. (Sisyphus Social Studies 15). Hamburg: Krämer: 79–154.

Spéder, Zs. and Kamarás, F. (2008). Hungary: Secular fertility decline with distinct period fluctuations. *Demographic Research* 19(18): 599–664. doi:10.4054/DemRes.2008.19.18.

Szabó, L. (2020). The relationships between childlessness and educational attainment among women born between 1920 and 1979 in Hungary. *Demográfia* 63(5): 5–39. doi:10.21543/DEE.2020-21.1.

Wood, J., Neels, K., and Kil, T. (2014). The educational gradient of childlessness and cohort parity progression in 14 low fertility countries. *Demographic Research* 31(46): 1365–1416. doi:10.4054/DemRes.2014.31.46.

Zeman, K. (2018). Cohort fertility and educational expansion in the Czech Republic during the 20th century. *Demographic Research* 38(56): 1699–1732. doi:10.4054/DemRes.2018.38.56.