A Kitagawa Decompositions

Here we provide additional detail on applying the Kitagawa (1955) method to the problem of decomposing overall fertility decline across cohorts into the part due to childlessness and the part due to lower fertility among the parous. The overall completed cohort fertility statistic is a weighted average of the mean completed cohort fertility of the parous and the nonparous (childless). The weights applied to these means are the fraction of the cohort that are parous and that are nonparous. So, letting p represent the fraction of a cohort that is parous, cohort fertility can be rewritten as a weighted mean:

$$\text{cohort fertility} = p \times (\text{average lifetime fertility among parous}) + (1-p) \times 0.$$

Comparing cohorts A and B, with parous fractions p^A and p^B respectively, the share of the difference in cohort fertility due to the difference in childlessness would be:

$$(p^A - p^B) \times \left(\frac{(\text{average lifetime fertility among parous})^A + (\text{average lifetime fertility among parous})^B}{2} \right),$$

where the superscripts A and B indicate cohort quantities, and the $(1-p)$ term is suppressed because it is multiplied by zero.

In our application, the groups A and B are earlier and later cohorts in the HFD. We compare the most recent cohort in the data for each country with the cohort born twenty years earlier, excluding countries that do not have a twenty-year span of cohorts. (Table A2 lists the countries and cohorts included.)

B Additional Notes on the Analysis of Indian DHS

In the Indian DHS, we study only one cohort (born 1980-84), and make cross-sectional comparisons: We compare low-fertility districts with high-fertility districts. There are 48 districts where cohort fertility was below 2 in the 1980-84 cohort. We compare these against the 48 districts with the highest cohort fertility.

In Table A1 we follow the methodology of Table 1, applying it to the Indian DHS data. In Table A1, the difference to be decomposed is cross-sectional, across districts for women born in the same set of years. In particular, the "low fertility" districts used in the table are the 48 Indian districts with cohort fertility below 2.0. These are compared with the 48 highest-fertility districts. The average difference between the high fertility and low fertility districts is large: 2.17 births. Almost all of this difference, 2.13 births (94%) is accounted for by the difference in fertility among the parous. Differing patterns of childlessness account for only 6% of the gap between high-fertility and low-fertility districts.

C The United States as an outlier

The United States is somewhat unusual in its patterns of fertility decline. In recent decades, birth rates in the US have been unlike birth rates in other low-fertility countries, as we

describe in Spears and Geruso (2025). For example, the period total fertility rate was relatively flat in the US over a 35-year span from about 1975 to about 2010, even as birth rates were falling elsewhere around the world. In addition, cohort average completed fertility substantially rose in the US from the 1958 cohort (1.99) to the 1978 cohort (2.20, the latest in the HFD). This pattern is an outlier compared to most other countries in the HFD: Of 18 other countries with data, cohort fertility fell in 17 of them over this period; in the 18th, Denmark, the increase was a much smaller 0.04 births. See Appendix Table A2 for a complete listing.

These facts prompt a question: Is childlessness also different in the US—for example, as the contrast between our findings for HFD cohorts born before 1980 and analysis by Kearney et al. (2022) of more recent US period fertility might suggest? Childlessness in the United States does appear to be somewhat different.

One of us collaborated with Wolfe (2024) to decompose a recent change in US birth rates into childlessness and average fertility among parous women, like in Tables 1 and A1. That analysis found a larger role for childlessness in the US than the results in this paper for a broader set of countries. In short, the conclusions in Wolfe (2024) are correct for the US, but the US is moderately unusual in international comparison. See Geruso and Spears (2025) for additional detail.

Table A1: Decomposition of fertility decline: Childlessness versus fewer children among the parous in Indian districts

Panel A: Sample means	low-fertility districts	high-fertility districts
number of districts in sample	48	48
average completed fertility in 1980-84 cohort	1.87	4.04
average completed fertility among parous in 1980-84 cohort	2.00	4.13
average childlessness in 1980-84 cohort	0.06	0.02
Panel B: Kitagawa-style decomposition		
Total difference in completed cohort fertility:	2.17 births	
Difference in fertility among parous:	2.13 births	
Difference in childlessness:	4.4 percentage points	
Difference due to childlessness:	0.13 births, or 6% of gap	
Difference due to fertility among parous:	2.04 births, or 94% of gap	

Notes: Decomposition compares 48 Indian districts with cohort fertility below 2.0 with the 48 highest-fertility districts. Each observation is an Indian district, which is an administrative subdivision of a state. In the data, there are 48 districts with completed cohort fertility below 2.0; we call these the "low-fertility districts." To match this sample size, we choose the 48 highest-fertility districts and call these the "high-fertility districts." Data are from India's 2019-2021 Demographic and Health Survey. All analyses are weighted by district population, as reflected in the DHS sample weights. Some fractions may not add to one due to rounding.

Table A2: Data for Human Fertility Database decomposition (in Table 1)

country	cohort	completed fertility	completed fertility among parous	% childless
Bulgaria	1957	2.04	2.08	2.0
Bulgaria	1977	1.66	1.76	6.0
Belarus	1954	1.92	2.03	5.7
Belarus	1974	1.57	1.80	12.5
Canada	1955	1.85	2.22	16.4
Canada	1975	1.80	2.22	18.8
Czech Republic	1957	2.07	2.20	5.9
Czech Republic	1977	1.74	2.00	13.0
Denmark	1959	1.88	2.20	14.7
Denmark	1979	1.91	2.21	13.3
Estonia	1955	1.97	2.10	6.1
Estonia	1975	1.84	2.12	13.1
Hungary	1956	1.97	2.14	7.8
Hungary	1976	1.66	2.02	17.8
Ireland	1958	2.49	2.87	13.4
Ireland	1978	2.02	2.38	15.4
Japan	1959	1.87	2.21	15.2
Japan	1979	1.48	2.03	27.3
Lithuania	1956	1.95	2.06	5.2
Lithuania	1976	1.77	2.05	13.5
Netherlands	1955	1.87	2.25	17.1
Netherlands	1975	1.78	2.14	16.9
Norway	1958	2.07	2.36	12.3
Norway	1978	1.98	2.25	12.0
Poland	1958	2.20	2.44	9.6
Poland	1978	1.51	1.95	22.5
Portugal	1959	1.95	2.02	3.8
Portugal	1979	1.57	1.74	10.1
Russia	1954	1.89	2.02	6.6
Russia	1974	1.61	1.80	10.4
Slovakia	1950	2.30	2.55	9.7
Slovakia	1970	1.93	2.18	11.5
Sweden	1959	2.05	2.36	13.4
Sweden	1979	1.92	2.23	13.9
Ukraine	1949	1.92	1.95	1.5
Ukraine	1969	1.60	1.71	6.6
United States	1958	1.99	2.38	16.2
United States	1978	2.20	2.49	11.5

Note: The United States is an outlier: In 17 of 19 countries, completed cohort fertility declined. It increased by a small 0.04-birth difference in Denmark, but increased by a 0.22-birth difference in the United States, which is about as large in absolute value (but opposite in sign) as the average change in this sample. Childlessness also declined in the US over this interval.