An historical perspective on the response of fertility to economic and mortality crises

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United Nations DESA: EXPERT GROUP MEETING ON THE IMPACT OF THE COVID-19 PANDEMIC ON FERTILITY

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1. Background

- Covid 19 led to sharp declines in fertility and births in many high income countries, with accelerated decline expected in 2021 (Kearney and Levine, 2020; Sobotka et al 2021).
  - In January 2021 declines range from 0 to 20%.

Fertility response to Covid 19 in US

- So far, total reported US Covid deaths are about 20% of normal annual deaths.
- Surveys US women:
  - Postponed intended births
  - Reduced coital frequency.
  - Some reduced desired number.
- Birth registration data show 10 to 15% birth decline following Covid, e.g. in California in January and February compared to 2020 (San Francisco Chronicle, April 26, 2021)
- Kearney and Levine (2020) expect deficit of 300,000 to 500,000 births due to Covid in 2021, around 10% reduction.

What should we expect going forward?
Lessons from economic and demographic crises in the past.

- Two Covid crises coincide:
  - health/mortality;
  - economy/unemployment.

- Here see historical responses to both mortality and food price variations in the past.

Why there might be a rebound above normal in a "natural fertility" population (no fertility target)

- In crisis year (year 0) fewer women than usual conceive. **Births slightly low**.
- In year 1 fewer are pregnant or lactating, *so more conceive*. **Births lower**.
- In year 2 **Births higher than normal.**
  - *these extra conceptions produce births*
  - plus all those that would have ordinarily given birth.
- In year 3 more than usual lactating and amenorrheic, so **Births low**.
- Pattern of rapidly diminishing cycles in births, length = interbirth interval=3 yrs or so.

And in a contracepting population aiming for target completed fertility

- Women may postpone conceiving or abort in year 0, so **births a little low.**
- In year 1 postponers do not give birth so **births low**
- In year 2 **births again above normal**
  - *postponers give birth*
  - *plus all those who planned for this year all along.*
- In year 3 more than usual lactating and amenorrheic, so **births low.**

- Natural fertility and target fertility respond in similarly.

2. Data and Methods

Data sources before vital registration

- Most historical studies analyze fluctuations in births and deaths relative to their trends.
  - For short run changes, just as good as TFR or life expectancy.
- Births, deaths and marriages based on European parish register records (Baptisms, Burials and Marriages).
  - Under-reporting etc. generally not a problem for short run fluctuations
- Food prices and real wages come from economic historians.
- For developing countries
  - Parish register data (e.g. in Latin America)
  - Vital registration
  - DHS has been used in sub-Saharan Africa

Econometric methods

- Estimate “distributed lag” models, effects of shock each month or year after, up to five years or 36 months.
  - Standard time series methods
  - Plots of estimated coefficients trace out the effects of earlier shocks.
- Often treat both economic crises and mortality (epidemics) as independent variables in multivariate regression (in annual, not monthly, regressions).
- Deal with causality issues by careful demographic reasoning and calculations.
  - Not due to reduction of marriage rates (way too small)
  - Not due to deaths of pregnant women or partners (way too small).
  - Rather due to conscious or stress related or health related fertility changes.

3. Estimates for England, 1538-1850

- Used great monthly data from hundreds of parishes (Wrigley-Schofield) (3444 months), and also annual data.
- I will show my results from earlier work.
- We will see England results generalize well to rest of Europe and to many developing countries.

Proportional change in fertility each month after change in mortality (controlling for food prices).

- P.365, pop hist of Eng
- Positive association at lag 0 is reverse causality: With high neonatal mortality, more births cause more deaths.
- Why do births start declining so soon after mort crisis?
  - Fetal mortality?
  - Abortion?
  - Migration?
- Striking drop at exactly 9 months
  - Reduced coital frequency?
  - Stress induced fetal loss?
  - Calculations show death of pregnant women or spouse could explain only very small part.

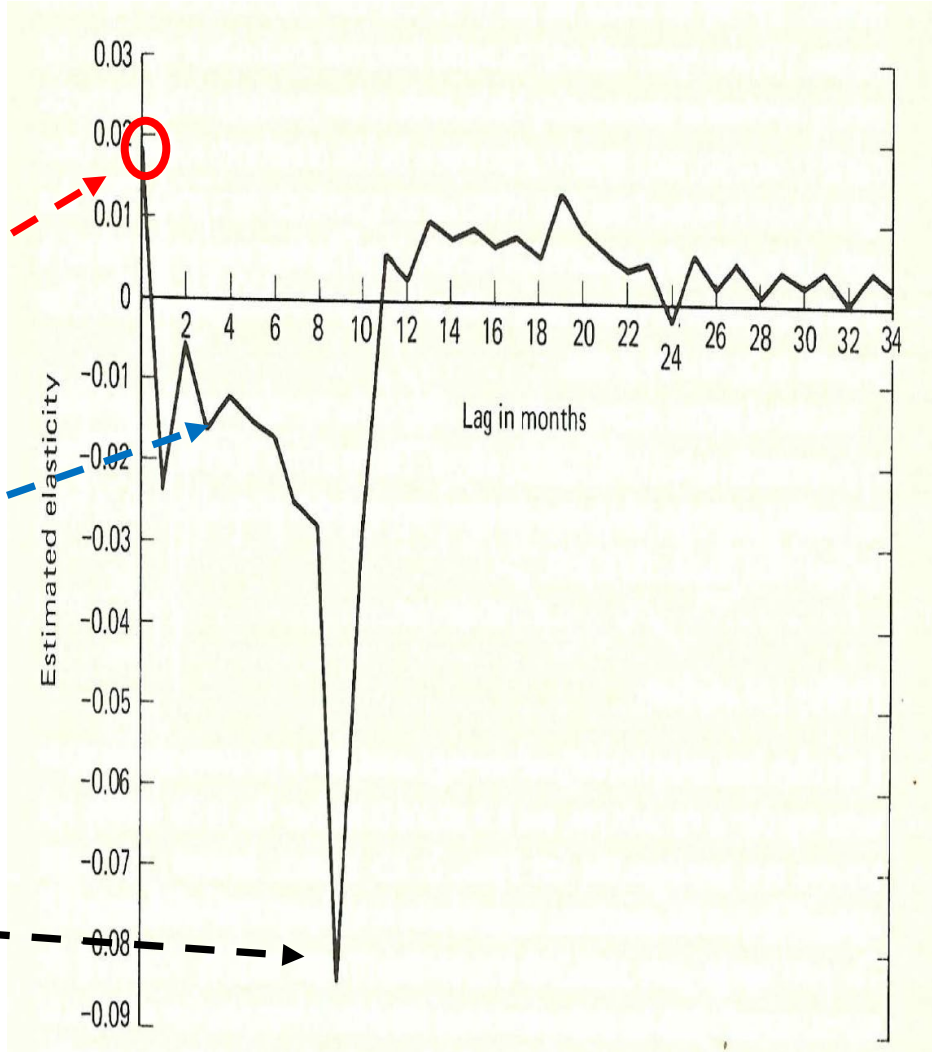


Figure 9.2: The reaction of fertility following a variation in mortality by elapsed months (estimated from monthly data 1547–1834)

Annual patterns can look quite different than monthly.

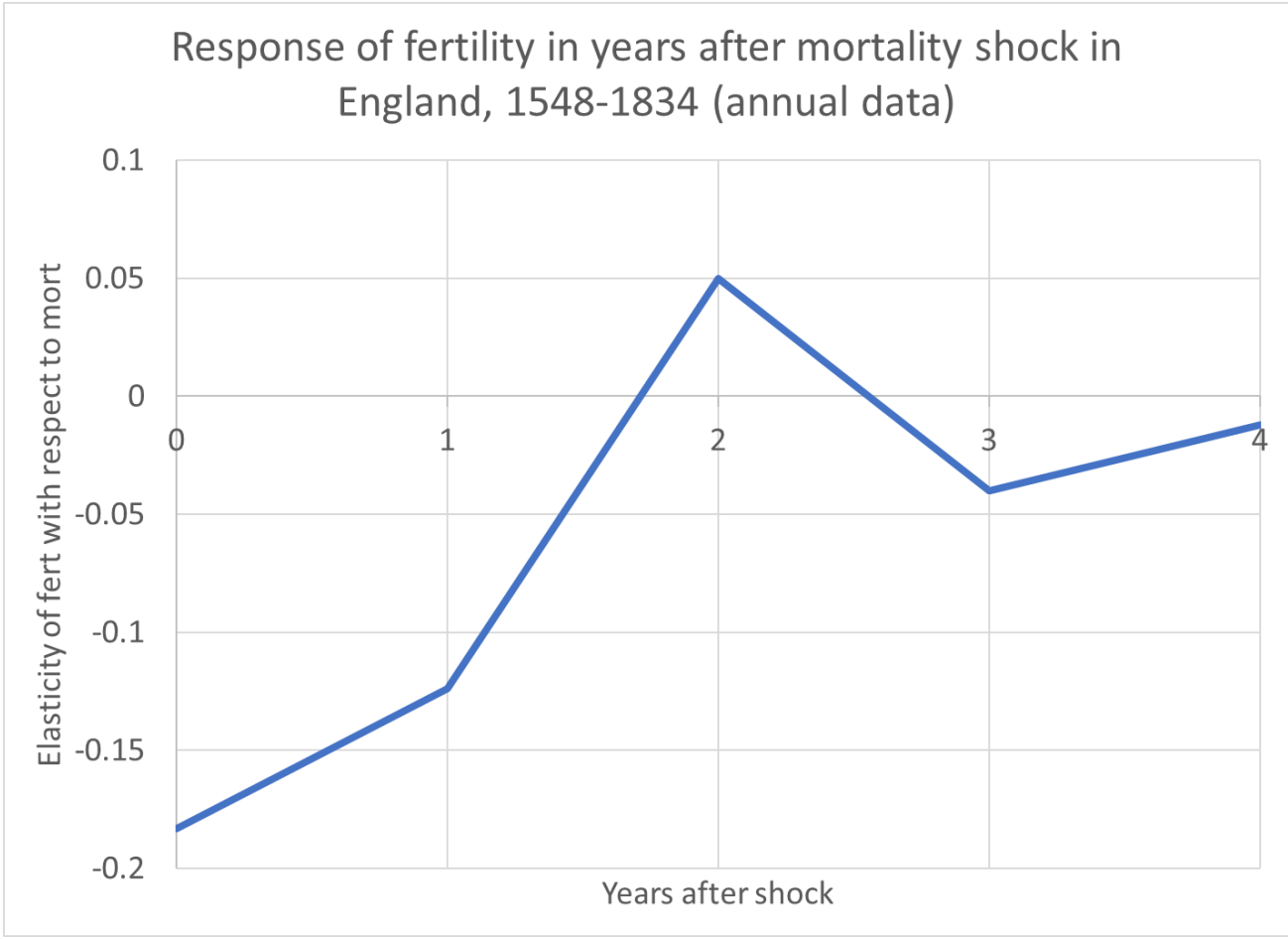
When during calendar year does shock occur?

Could be in January at start, could be in December at end.

This annual pattern is completely consistent with the monthly pattern, though looks very different.

And still have initial shock and bounce back above normal.

Note diminishing cycle.



Fertility response to wheat price shock

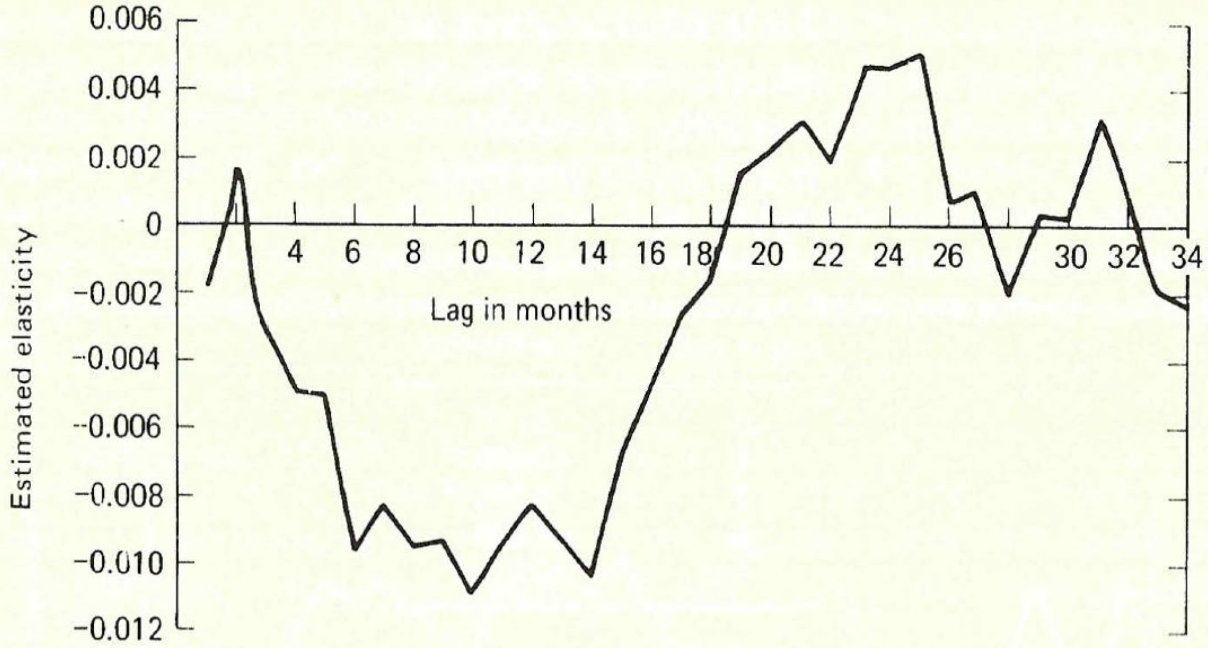
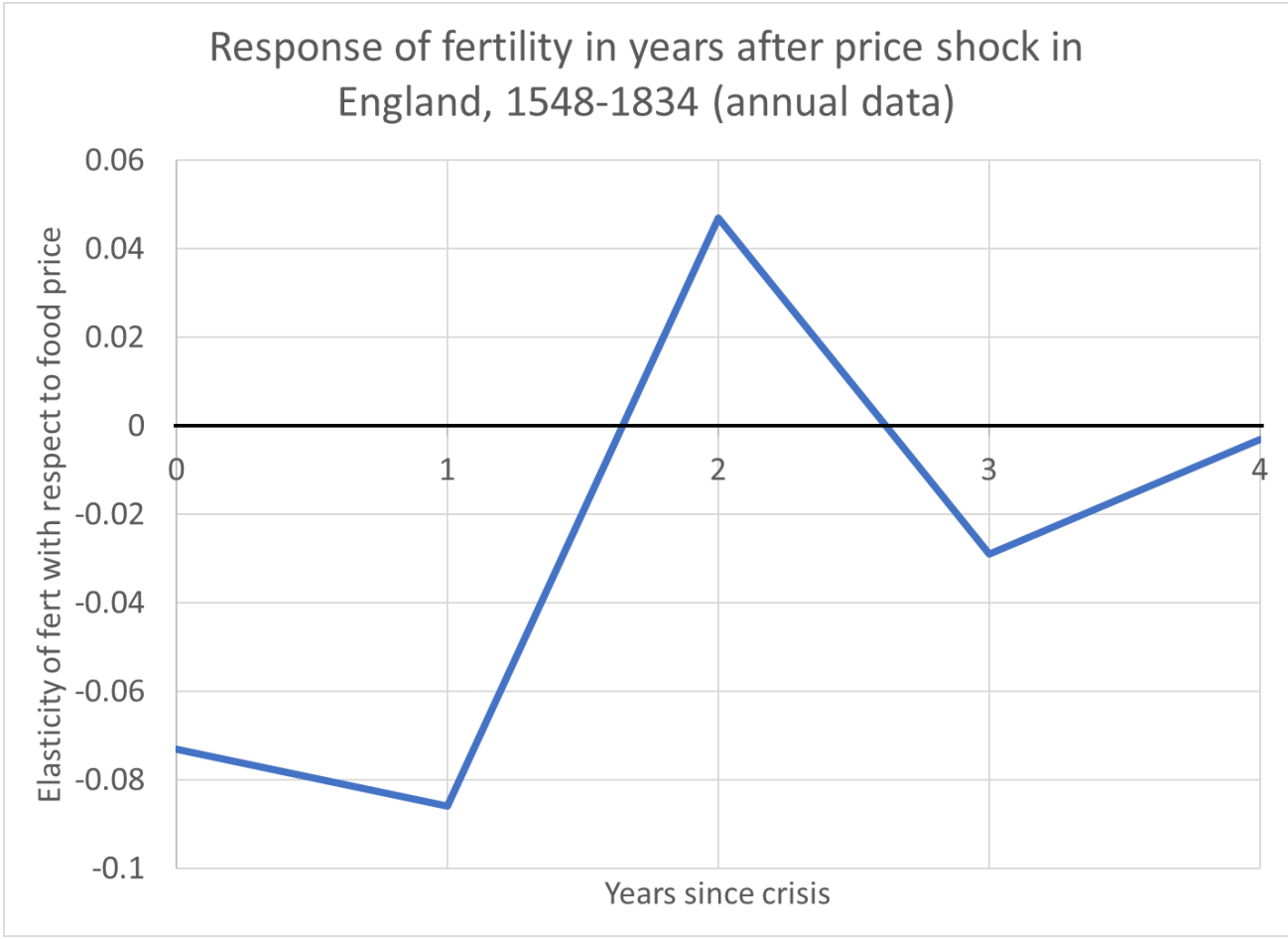


Figure 9.5: The reaction of fertility following a variation in wheat prices, by elapsed months (estimated from monthly data 1691–1834)

Notes: The individual coefficients were smoothed by a 5-point, then a 3-point moving average, except for the second and third points which were smoothed by 3-point and 5-point moving averages respectively. The coefficients were estimated by a regression corrected for second order autoregressive disturbances.

Response of fertility to price shock in annual harvest year data



4. Similar estimates for other countries

How sensitive was the response in different places?

- Sum all the positive and negative coefficients to find the total net effect.

Medians of total responses by country.

Table 1
Cumulative elasticities of fertility and mortality with respect to real incomes: median values for sets of studies for four regions[a]

	Fertility	Mortality
Preindustrial Europe (14)	+0.12	–0.15
Asia (7)	+0.26	–0.19
Latin America (9)	+0.31	–0.20
Sub-Saharan Africa (7)	+0.32	–0.30

[a]The number of populations studied is given in parentheses. For Europe and Asia, most of the elasticities are for the negative of food prices. For Latin America and sub-Saharan Africa, most of the elasticities are with respect to per capita GNP. For Africa, retrospective individual demographic data are used; for other regions, aggregate rates are used. *Sources*: For preindustrial Europe and Asia, see Lee (1990). For mortality in Latin America, see Palloni and Hill (1992); for fertility in Latin America, see Reher and Ortega-Osona (1992). For sub-Saharan Africa, see National Research Council (1993).

Source: Lee, Ronald (1997) "Population Dynamics: Equilibrium, Disequilibrium, and Consequences of Fluctuations," Chapter 19 in Mark Rosenzweig and Oded Stark, eds., *Handbook of Population and Family Economics, v.1B* (North Holland, 1997), pp.1063-1115.

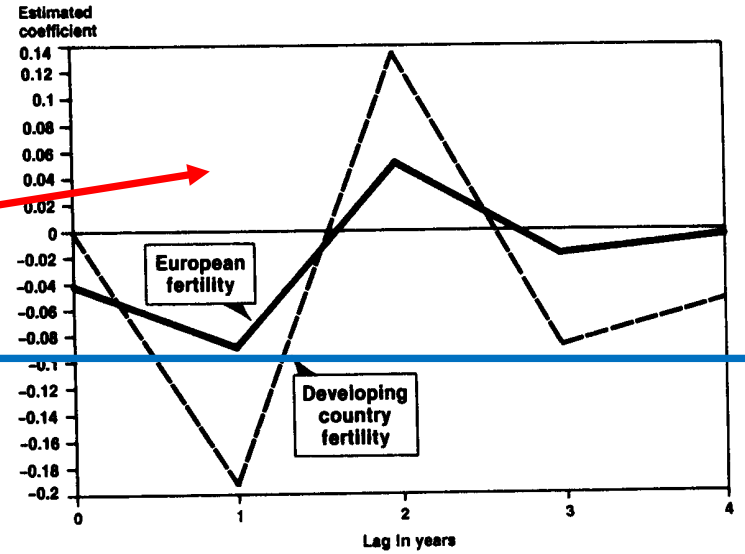
What about the timing of the response?

Median estimates

*As estimated

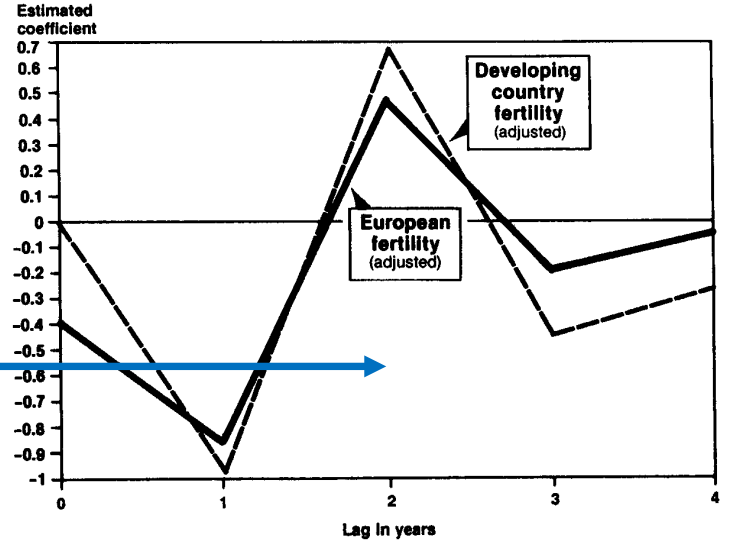
*Divided by total

Figure II. The influence of food prices on fertility: estimated lagged effects for selected populations in Europe and the third world, for various periods from the sixteenth century to the present



Sources: The estimates for Europe are taken from Patrick Galloway, "Basic patterns in annual variations in fertility, nuptiality, mortality and prices in pre-industrial Europe", *Population Studies* (London), vol. 42, No. 2 (July 1988). They are medians of the estimates in his appendix table 1 for 14 European populations, mostly for 1750-1870, but some for earlier periods. The developing country pattern is the median of estimates for Japan (two subperiods) from Patrick Galloway and Ronald Lee, "Some possibilities for the analysis of aggregate historical demographic data from China", a paper presented at the Workshop on Qing Population History, Pasadena, California, 26-30 August 1985, and from Griffith Feeney and Kiyoshi Hamano, "Rice price fluctuations and population change in late Tokugawa Japan", a working draft (Honolulu, East-West Population Institute, 1988); for Mexico: David Sven Reher, "Population and economy in eighteenth century Mexico: an analysis of short-term fluctuations", a paper prepared for the IUSSP Conference on the Population History of Latin America, Ouro Preto, Brazil, 2-6 July 1989; and for Taiwan (Province of China) and Bombay: Patrick Galloway and Ronald Lee, "Some possibilities for . . .", *loc. cit.*

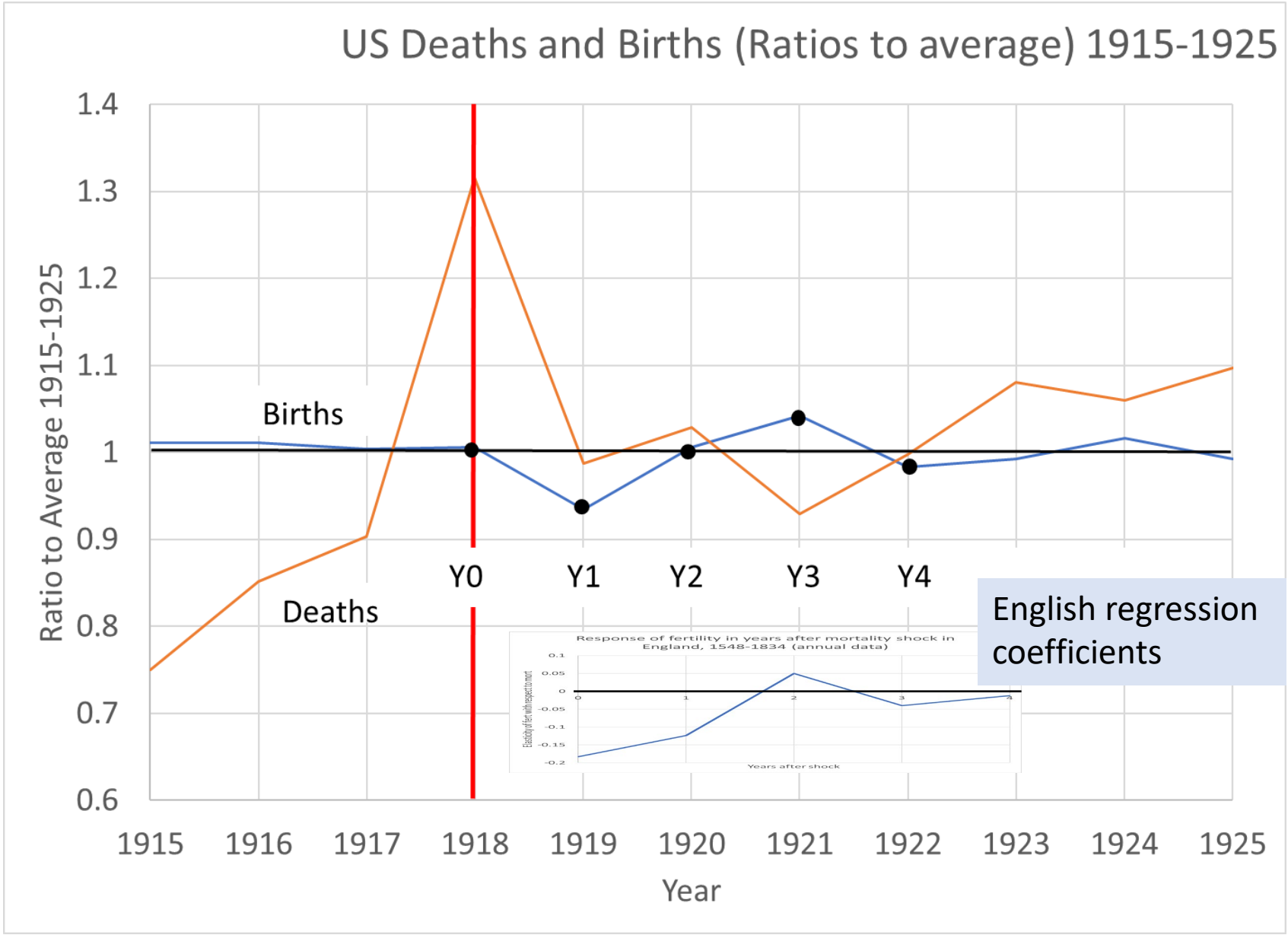
Figure III. The adjusted influence of food prices on fertility: estimated lagged effects for selected populations in Europe and the third world, for various periods from the sixteenth century to the present



Sources: The estimates presented in figure II were normalized by dividing them by their sums for each set of populations, to remove the influence of differences in overall sensitivity of response. The estimates for Europe are taken from Patrick Galloway, "Basic patterns in annual variations in fertility, nuptiality, mortality and prices in pre-industrial Europe", *Population Studies* (London), vol. 42, No. 2 (July 1988). They are medians of the estimates in his appendix table 1 for 14 European populations, mostly for 1750-1870, but some for earlier periods. The developing country pattern is the median of estimates for Japan (two subperiods) from Patrick Galloway and Ronald Lee, "Some possibilities for the analysis of aggregate historical demographic data from China", a paper presented at the Workshop on Qing Population History, Pasadena, California, 26-30 August 1985, and from Griffith Feeney and Kiyoshi Hamano, "Rice price fluctuations and population change in late Tokugawa Japan", a working draft (Honolulu, East-West Population Institute, 1988); for Mexico: David Sven Reher, "Population and economy in eighteenth century Mexico: an analysis of short-term fluctuations", a paper prepared for the IUSSP Conference on the Population History of Latin America, Ouro Preto, Brazil, 2-6 July 1989; and for Taiwan (Province of China) and Bombay: Patrick Galloway and Ronald Lee, "Some possibilities for . . .", *loc. cit.*

Source: Lee, Ronald (1990) "The Demographic Response to Economic Crisis in Historical and Contemporary Populations," *Population Bulletin of the United Nations*, n.20, pp. 1-15.

1918 Influenza pandemic -- Actual series of births and deaths as ratios to average values 1915-25.



5. Implications for forecasting fertility

- Summary
  - A shock to fertility and births gives rise to diminishing cycles in fertility and births.
  - Cycle period (trough to trough) is close to length of interbirth interval (around 3 years).
- Expected trajectory of fertility:
  - Drop below normal in year 1 (2021)
  - Rebound to above pre-Covid level in year 2 (2022)
  - Drop slightly below normal in year 3 (2023)
  - Approach normal in year 4 (2024).
- Implications for fertility projections.
  - Neither below-normal levels of 2021 nor above-normal in 2022 nor below in 2023 should influence the fertility forecasts. Transitory and potentially misleading.
  - **Ignore the Covid 19 crisis when forming longer run fertility projections.**
  - **Instead use average fertility over a few years before Covid as the jump-off level.**
- Caveat – unless other evidence suggests otherwise.

END

References

- Sobotka, Tomáš, Aiva Jasilioniene, Ainhoa Alustiza Galarza, Kryštof Zeman, László Németh, and Dmitri Jdanov (2021) "Baby bust in the wake of the COVID-19 pandemic? First results from the new STFF data series" (Version 24 March 2021) Preprint March 2021 DOI: 10.31235/osf.io/mvy62.
- Kearney, Melissa S. and Phillip B. Levine (December 17, 2020) "The coming COVID-19 baby bust: Update" *Brookings* series Middle Class Memos.
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- Galloway Patrick R. (1988) "Basic Patterns in Annual Variations in Fertility, Nuptiality, Mortality, and Prices in Pre-industrial Europe", Population Studies, 42:2, 275-303, DOI: 10.1080/0032472031000143366

Books by Sheps and Menken and by Louis Henry model the reproductive cycle and simulate exactly the kinds of diminishing oscillations that these historical studies estimate.