HIV/AIDS and Fertility

Jane Fortson

Becker Fellow
University of Chicago
Background: The HIV/AIDS Epidemic

- HIV prevalence in sub-Saharan Africa increased substantially in the late 1980s and early 1990s
- Life expectancy has fallen dramatically
- HIV prevalence among adults = 5.0% (2007)
- Effect on economic growth: inconclusive
Background: Why Might HIV Affect Fertility?

- Physiological effects of HIV infection on fecundity: ↓

- Behavioral effects:
  - Infection avoidance: ↓
  - Quantity-quality model of childbearing: ↑
Existing evidence on the effect of HIV on fertility: inconclusive

- Declines in fertility
  (e.g., Young, 2005, Young, 2007)

- Increases in fertility
  (e.g., Kalemli-Ozcan, 2008)

- No effect
  (e.g., Juhn, Kalemli-Ozcan, and Turan, 2008)
Aim: understand effects of HIV on fertility overall, understand behavioral response of fertility to HIV

Methodological gain: better estimates of fertility over time

Approach: difference-in-differences, tying trends in fertility to cross-sectional variation in HIV prevalence
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Find:

(1) estimates are small and insignificant; can rule out estimates from past work
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Methodological gain: better estimates of fertility over time

Approach: difference-in-differences, tying trends in fertility to cross-sectional variation in HIV prevalence

Find:

(1) estimates are small and insignificant; can rule out estimates from past work

(2) estimates are likewise small and insignificant when looking at a sample of HIV-negative women
Demographic and Health Surveys (DHS): Fertility

- Nationally-representative cross-sections
  - Côte d’Ivoire (1994, 2005)
  - Ethiopia (2000, 2005)
  - Mali (1995/6, 2001)
  - Rwanda (2000, 2005)

- Complete birth histories for women 15-49
Calculating the total fertility rate:

\[ tfr_{rt} = 5 \sum_a asfr_{rta} = 5 \sum_a \frac{babies_{rta}}{exposure_{rta}} \]

where \( a \) represents a five-year agegroup.

TFR can be thought of as the number of children a woman will have over her lifetime, based on current birth rates across the age distribution.
My approach: estimate fertility among women 15-39 for each of 10 years prior to the survey

**Figure:** Example: Kenya, 2003 - full birth histories for women 15-49
Figure: Fertility Rates Over Time
Demographic and Health Surveys (DHS): HIV

- Previous data on HIV: antenatal clinics, other subpopulations
- These data: household-based blood testing
- Non-response: about 80 percent were tested; refusal made up about 2/3 of non-response
- Can link HIV test results to individual characteristics
- HIV prevalence estimated at region level

HIV Prevalence
- 21 - 24
- 18 - 21
- 15 - 18
- 12 - 15
- 9 - 12
- 6 - 9
- 3 - 6
- 0 - 3
- No data

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Example: Regional HIV Prevalence in Tanzania, 2003
Empirical Model

**Figure:** Difference-in-Differences Scatterplot
Empirical Model

Difference-in-Differences Approach:

\[ tfr_{rt} = \beta_0 + \beta_1 \text{HIV}_r \times \text{Post}_t + \beta_2 \text{HIV}_r + \beta_3 \text{Post}_t + \epsilon_{rt} \quad (2) \]
\[ tfr_{rt} = \beta_0 + \beta_1 \text{HIV}_r \times \text{Post}_t + \alpha_r + \gamma_t + \epsilon_{rt} \quad (5) \]
\[ tfr_{rt} = \beta_0 + \beta_1 \text{HIV}_r \times \text{Post}_t + \alpha_r + \eta_{nt} + \epsilon_{rt} \quad (6) \]

where \( tfr_{rt} \) = total fertility rate in region \( r \) in year \( t \),
\( \text{HIV}_r \) = prevalence in region \( r \) in survey year,
\( \text{Post}_t \) = 1 if year \( t \) is 2000 or later (0 if 1990 or earlier),
\( \gamma_t \) = fixed effect for year \( t \),
\( \alpha_r \) = fixed effect for region \( r \), and
\( \eta_{nt} \) = fixed effect for country \( n \) in year \( t \).
## Table II: Difference-in-Differences Results

<table>
<thead>
<tr>
<th>FERTILITY RATE</th>
<th>(2)</th>
<th>(5)</th>
<th>(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV Prevalence × Post-2000</td>
<td>0.000</td>
<td>-0.004</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.016)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>HIV Prevalence</td>
<td>-0.058*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.018)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-2000</td>
<td>-1.229*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.125)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTROLS</th>
<th>( \beta_0 )</th>
<th>( \beta_0, \alpha_r, \gamma_t )</th>
<th>( \beta_0, \alpha_r, \eta_{nt} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIT OF OBSERVATION</td>
<td>Region</td>
<td>Region</td>
<td>Region</td>
</tr>
<tr>
<td></td>
<td>× Pre/Post</td>
<td>× Year</td>
<td>× Year</td>
</tr>
<tr>
<td>N</td>
<td>216</td>
<td>1050</td>
<td>1050</td>
</tr>
</tbody>
</table>

Notes. Data from years 1991-1999 are excluded. Standard errors are clustered on the region. * = p-value < .05
Results

► Interpretation: 5% prevalence \(\Rightarrow\) fertility \(\uparrow\) .01 children
(95% confidence interval: -0.22 to 0.25)

► By comparison:

Young (2007): 5% prevalence \(\Rightarrow\) fertility \(\downarrow\) 10%

Kalemli-Ozcan (2008): 5% prevalence \(\Rightarrow\) fertility \(\uparrow\) 0.34 children
Channels

- Overall effect of HIV on fertility: negligible
- Could obscure significant, offsetting effects, e.g., a physiological decline in fertility and a behavioral increase
- To test: use individual HIV test results to distinguish between HIV-positive and HIV-negative women
- Fertility is higher among HIV-negative women, consistent with previous research
Table III: Channel Analysis

<table>
<thead>
<tr>
<th>FERTILITY RATE</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV Prevalence × Post-2000</td>
<td>0.011</td>
<td>0.003</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.022)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Year</td>
<td>-0.085*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONTROLS**

- $\beta_0, \alpha_r$
- $\beta_0, \alpha_r, \gamma_t$
- $\beta_0, \alpha_r, \eta_{nt}$

**UNIT OF OBSERVATION**

- Region × Year
- Region × Year
- Region × Year

**N**

<p>| | | | |</p>
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<tr>
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<tbody>
<tr>
<td></td>
<td>724</td>
<td>724</td>
<td>724</td>
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</tbody>
</table>

*Notes. Data from years 1991-1999 are excluded. Fertility Rate for post-2000 years is calculated among HIV-negative women. Standard errors are clustered on the region. * = p-value < .05*
Threats to Validity

- Small sample size
- Mortality
- Endogenous and omitted regressors
- Fertility among women 40-49
- HIV test non-response
- Measurement error
- Transformations of the dependent variable
Findings and Implications

- Using a difference-in-differences approach, find evidence of a robust, small effect of HIV on fertility rates in sub-Saharan Africa.

- Can rule out estimates of past studies (both positive and negative).

- The effect of HIV on fertility among non-infected women is likewise small.

- The fertility-driven effect of HIV on population size is small.

- Methodology (to calculate historical fertility rates) can be applied to other research questions, settings.