



Twenty Year Economic Impacts of Deworming in Kenya

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Motivation

Do child health investments increase adult living standards?

- This question is of great interest to researchers, and of major policy importance for governments and aid donors, but solid answers remain elusive in low-income countries (Martorell et al 2010, Almond et al. 2017).
- Why? Many methodological challenges:
 - >> Non-random child health investments (i.e., sick children may have other disadvantages, such as poverty)
 - >> Few longitudinal (panel) datasets tracking children into adulthood
 - >> Measurement of living standards in low-income regions.



Focus on the problem of worm infections in rural Kenya

- 1 in 5 people globally remain infected with intestinal worms, with major disease burden (due to anemia, growth stunting, lethargy), especially among children in Africa and Asia (Pullan et al 2014).
 - Intestinal worms may have other adverse consequences for the immune system (Kirwan et al 2010), gut microbiome (dysbiosis).
 - Prevalent worms in Kenya: hookworm, roundworm, whipworm, and schistosomiasis
- >> Transmission through frequent reinfection with fecal matter (contact or ingestion); worms have a limited lifespan.



WHO recommends mass school-based deworming treatment in endemic areas (typically >20% prevalence)

- Screening is expensive, but drugs are inexpensive and safe
 - Existing survey finds benefits for infected children, but is under-powered to detect population impacts (Taylor-Robinson et al 2015)
 - Recent meta-analysis incorporating more studies and focusing on settings with >20% prevalence finds positive population impacts on child weight (and height); mass treatment 23x more cost effective than school feeding (Croke et al 2019)
- >> Limited evidence re: long-run impacts on living standards



This Project

Reports on a long-run 20 year follow-up of the Primary School Deworming Project (PSDP) in Kenya (1998-2003)

- 75 primary schools (30,000 children aged 6-18), with deworming treatment phased in over three years in 25 schools at a time.
- Rural district with 90 percent worm infection rates at baseline. Treatment with albendazole (twice per year) and praziquantel costs <0.50 USD per child.





Busia, Kenya
1998





Previous Findings

Mass deworming led to schooling gains and community health benefits, at low cost (Miguel and Kremer 2004).

- Rates of serious worm infections fell by half, from 52% to 25%. There were also gains in self-reported health, height.
 - Increased school participation in the first two years of the project, with absenteeism falling by one quarter, or 6 percentage points.
- >> Re-infection fell among other community members, including untreated children in treatment schools and those living within 4 km.



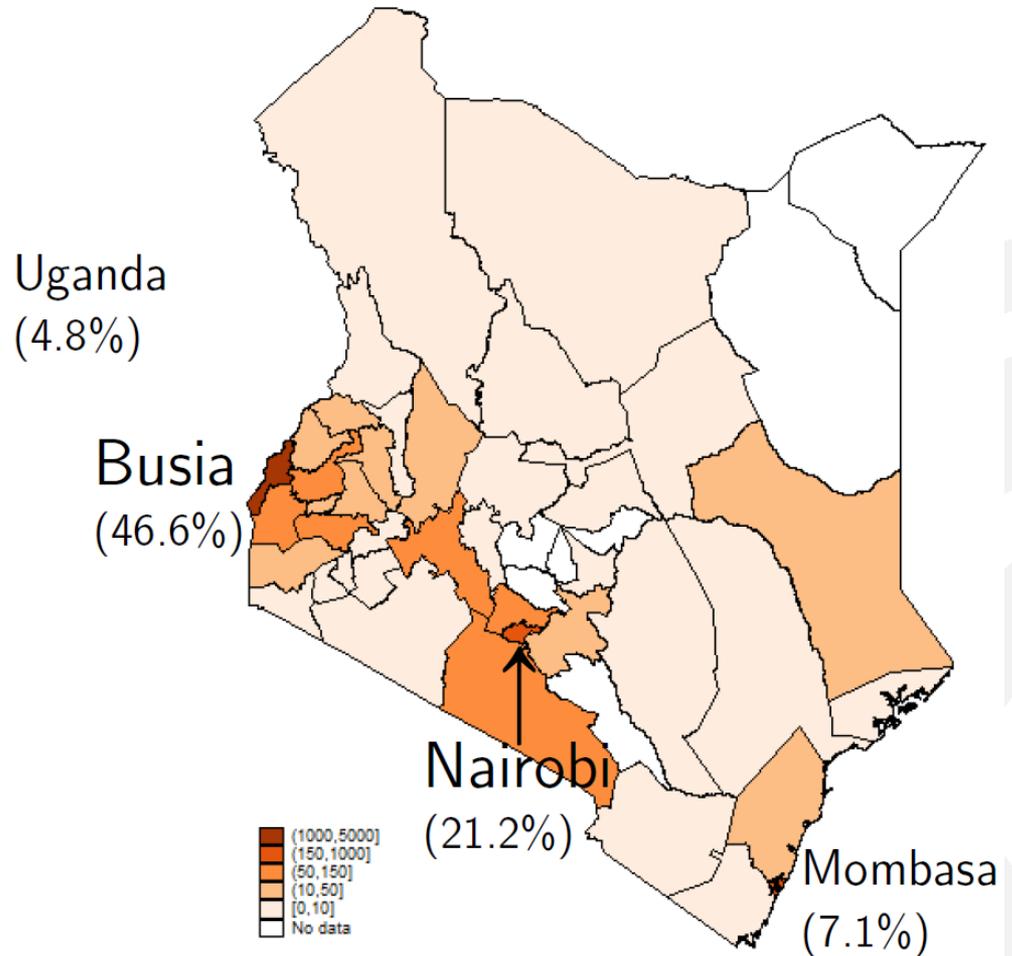
Assessing long-run impacts

The Kenya Life Panel Survey (1998-2019) data project

- A representative sample of 7,530 of the baseline deworming sample (in grades 2-7) were tracked over time to assess long-run impacts on income, living standards, other life outcomes.
 - Unusual element: KLPS individuals “tracked” as they move throughout Kenya and East Africa (and surveyed by phone if abroad). Regularly contact via cell phones.
 - Two phase tracking approach, with “intensive” follow-up for subset
- >> An effective tracking rate of 85% (among those still alive), a high rate for a young adult population over the course of 20 years.



Residential location of KLPS-4 respondents





Estimate 10 to 20 year impacts utilizing KLPS rounds 2, 3 and 4

- Are there persistent labor market and livings standards gains?
- Noteworthy aspects of KLPS-4:
 1. 20 year longitudinal data in African populations are extremely rare
 2. Respondent tracking high (85% among those alive), balanced across arms
 3. Detailed measurement of subsistence agriculture productivity
 4. Inclusion of a full Consumption Expenditure Module for all KLPS-4 respondents
 5. Registration of a pre-analysis plan for KLPS-4 (AEARCTR-0001191)



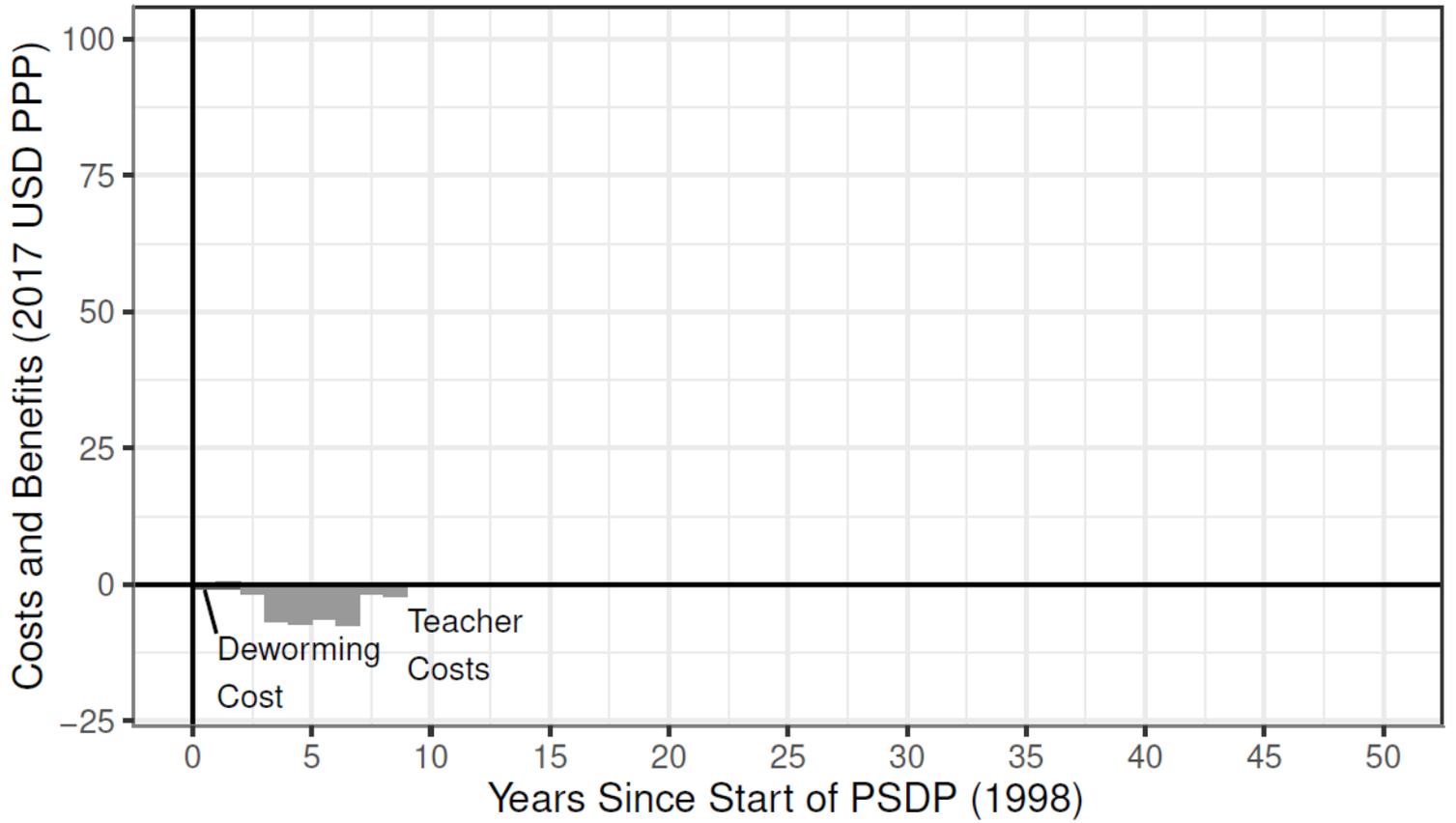
Deworming as an Investment

Does child deworming pay in economic terms?

- **Costs:** deworming pills and delivery cost per child is low in school-based mass treatment (<0.50 USD), subsidy S , for +2.4 years of treatment.
 - Plus additional teacher salaries to maintain class sizes at pre-program level due to increased enrollment, cost per unit increase in schooling (Baird et al 2016).
 - **Benefits** are the higher earnings in the treatment group, λ_1 .
 - Government revenue benefit: Kenya collects share 16% of income in taxes, τ .
- >> Compute future earnings gains, NPV of future government revenue, and social internal rate of return over a working life (of 40 years).

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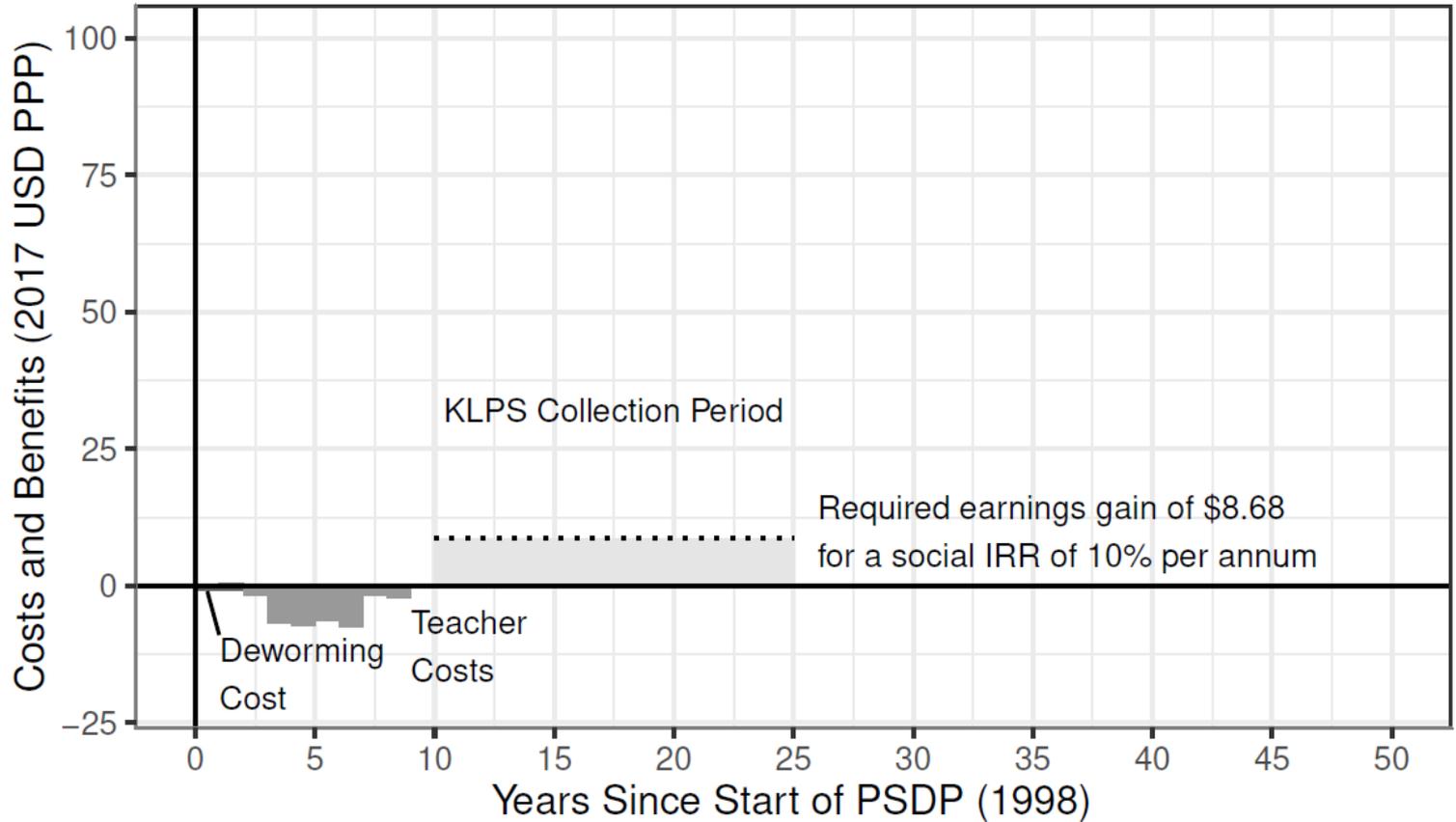
Timeline of deworming project costs and benefits, from 1998 (t=0) to t+50 years.





Timeline of deworming project costs and benefits, from 1998 (t=0) to t+50 years.

Social IRR of 10% with an annual earnings gain of US\$8.68, or +0.7%.





20 Year Economic Impacts

Treatment increases earnings and consumption by +6 to 14%

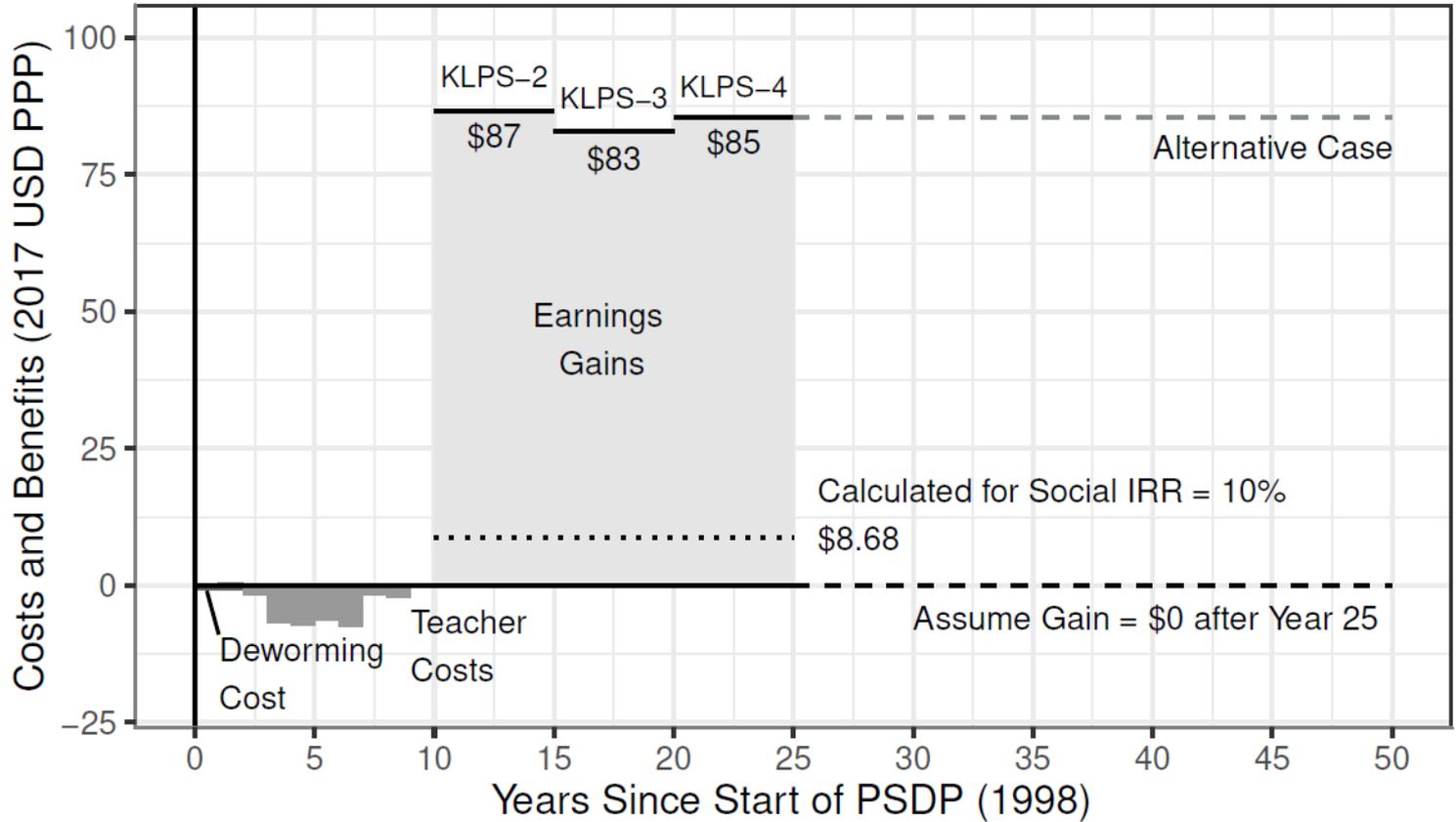
- Pooling data from KLPS 2, 3, 4: 10 to 20 year follow-up.
- Hourly earnings up +18% ($p < 0.10$)
- Somewhat larger productivity and living standards gains for males than females
- >> Individuals shift their labor effort into non-agricultural activities ($p < 0.01$).

- Migration to urban areas increases substantially ($p < 0.05$)
- >> Over a third of urban migrants live in the capital Nairobi



NPV of
deworming (per
child):
US\$245.

Social IRR of
deworming (per
annum):
38.4%.





Discussion

Childhood health investments in Kenya led to improved adult labor market earnings and living standards 10 to 20 years later

- Implications: health investments for school-age children (above age 0-5) can still have meaningful impacts on adult life outcomes.

>> Context: Busia district is a high worm infection setting, and the baseline period (1998) had particularly high worm prevalence due to flooding

- **Tracking of the Kenya Life Panel Survey (KLPS) sample continues**
- New activity: data collection on children (aged 3-9) of the original KLPS participants. Do child health investments reduce the intergenerational transmission of poverty?

