

# Population Projections of African Countries Based on Historical Rates of Fertility Decline

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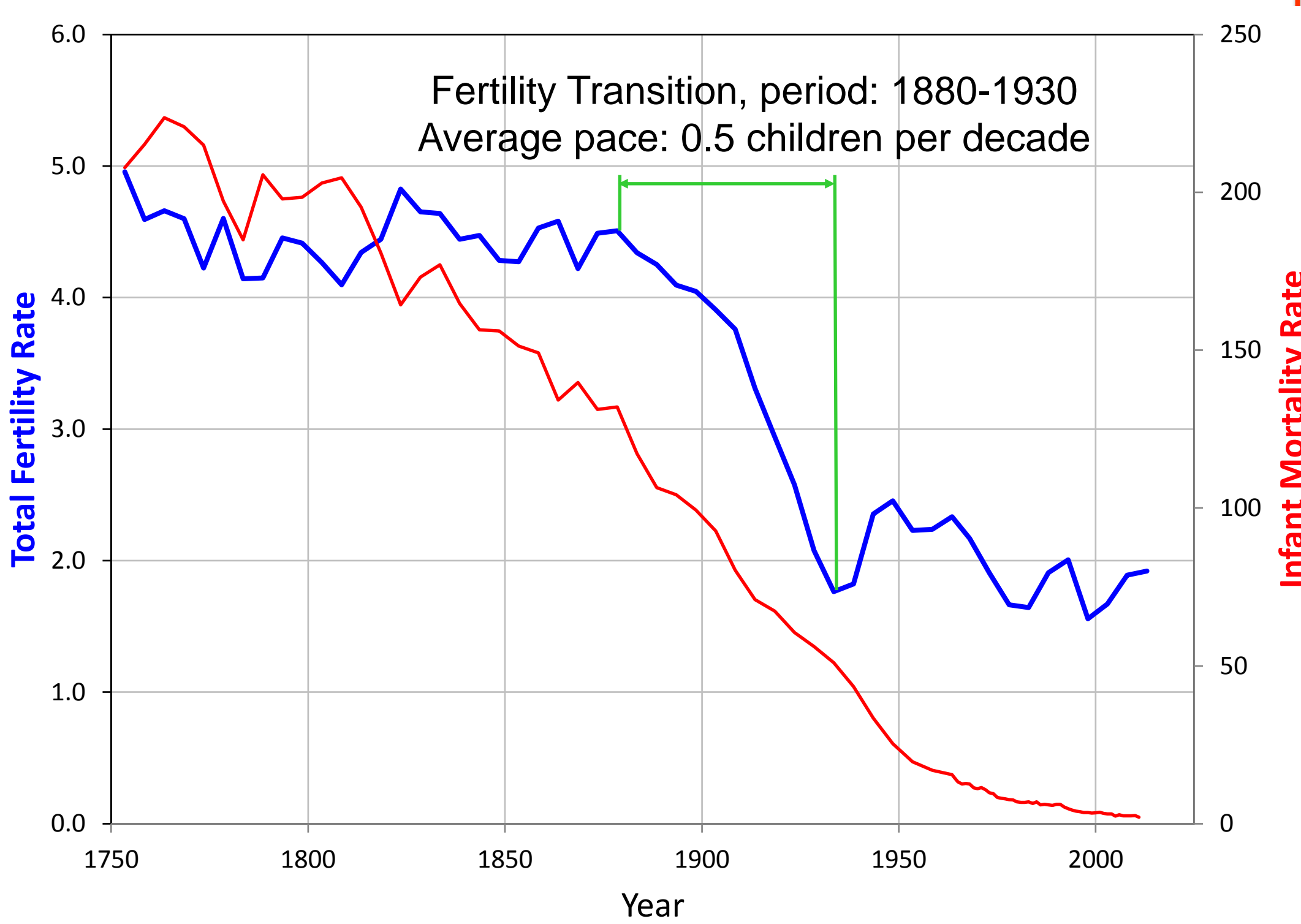
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**Objective** To produce population projections of African countries based on average pace of fertility decline observed during fertility transitions in national populations.

**Basic Assumptions:** a) fertility transition in all African countries is now underway; b) fertility decline will proceed at average historical pace observed during historical fertility transitions in national populations.

## Fertility Transition in Sweden



**Model** We assume that a) pace of fertility decline  $d_{c,t}$  depends only on the current fertility level in a country if a country had entered fertility transition and b) that the functional form  $d_{c,t}$  is the same for all countries:

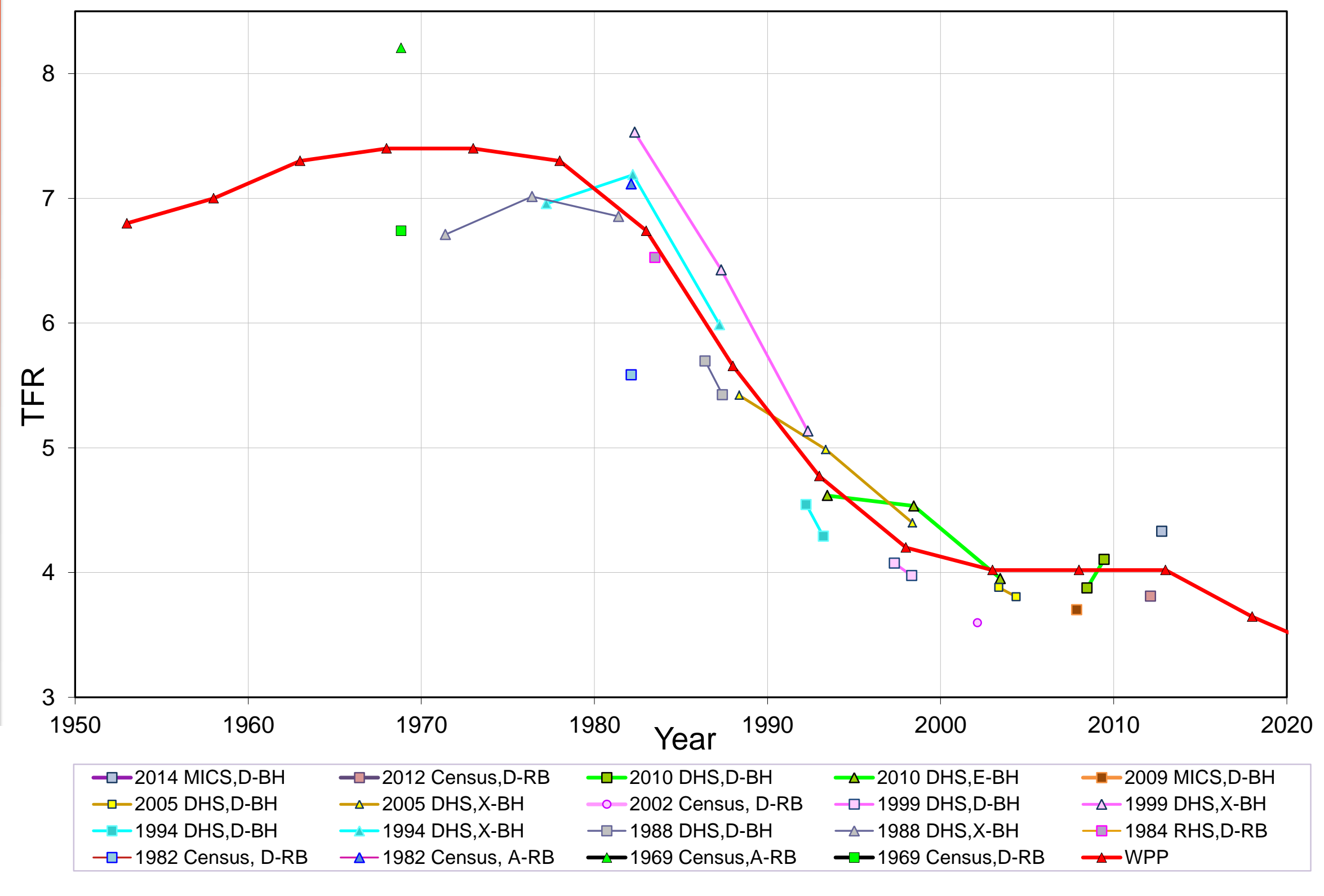
$$d_{c,t} = d(TFR_{c,t})$$

The model rests on assumption that the past fertility trends in a country before the fertility transition have no influence on the future fertility trends—after having entered the fertility transition stage fertility decline will proceed at a historical pace observed in the countries that have passed through their fertility transitions.

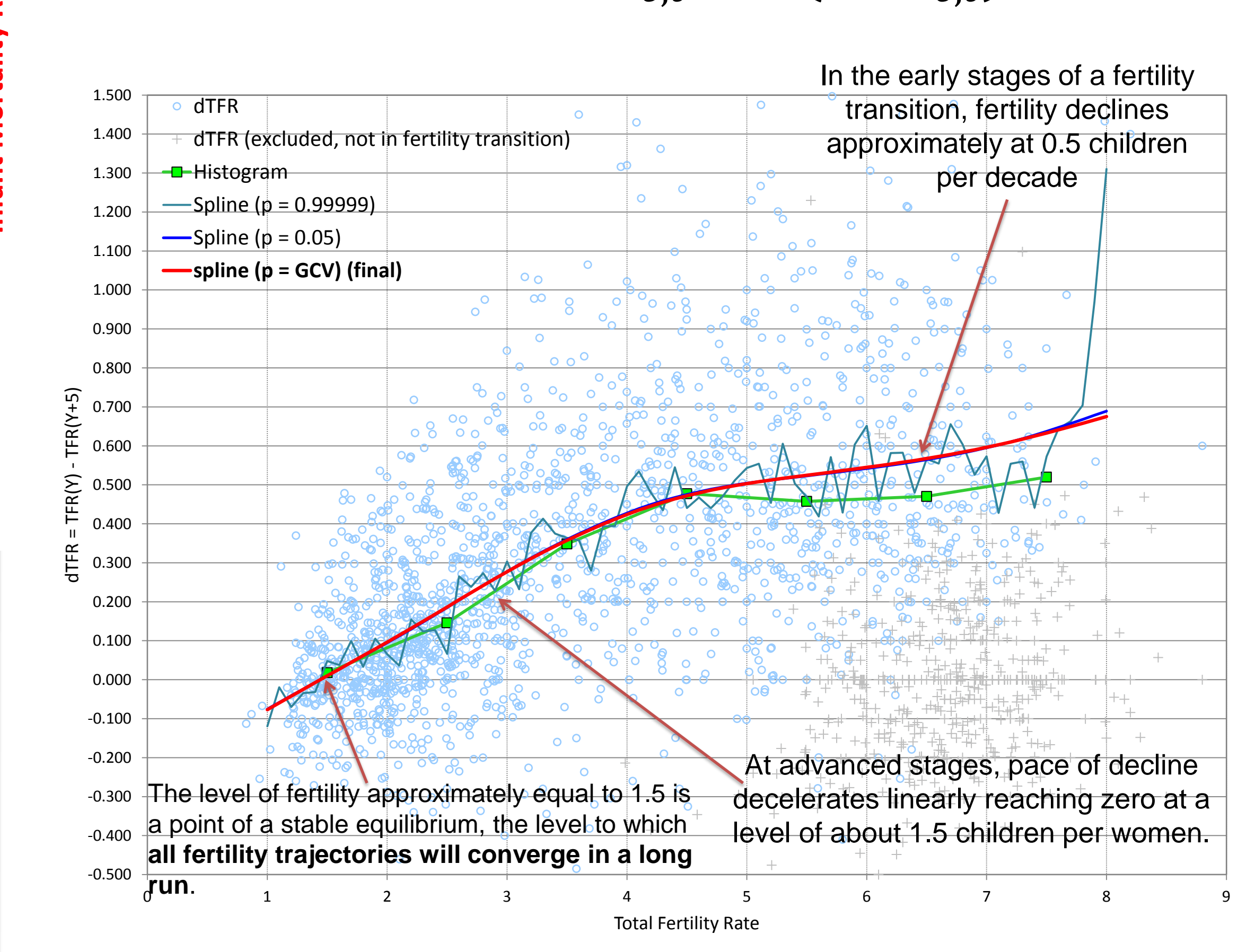
**Fertility Data** UN fertility estimates, for 201 countries and for the period 1950-2015 from the 2015 revision of the World Population Prospects (WPP).

## Fertility Estimates and Empirical Data: Zimbabwe

See *World Fertility Data 2015* for plots for all countries: <http://goo.gl/PlwhFz>



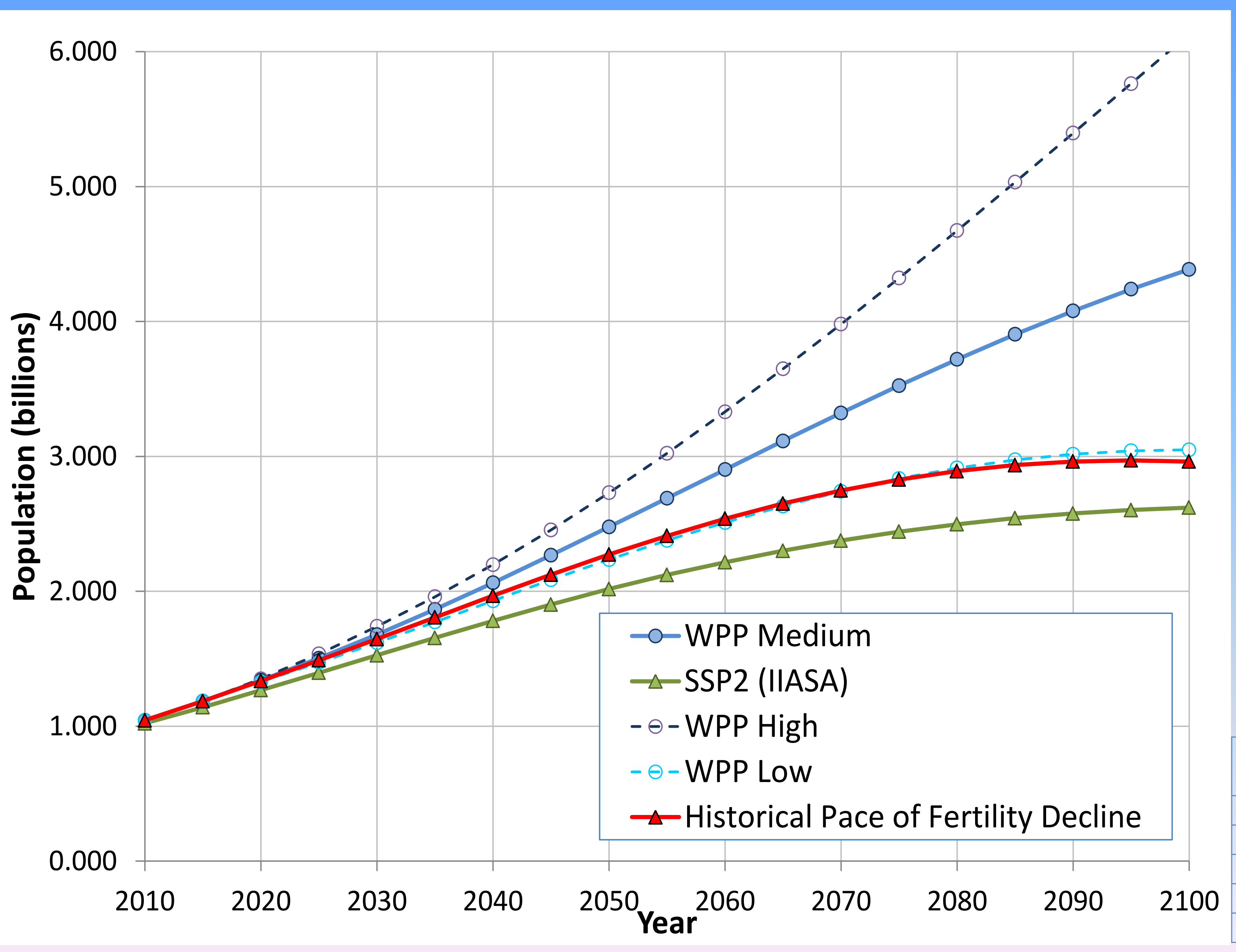
## Model Fit, $d_{c,t} = d(TFR_{c,t})$



Fitting the model involves two steps: 1) estimating fertility transition periods for all countries (challenging) and 2) fitting spline to estimate relation  $d_{c,t}$  (easy). The GCV spline was found to provide a good approximation. It could further reduced to a 3-parameter linear model.

**Population Projections** The estimated  $d_{c,t} \sim spline(TFR_{c,t})$  was applied to TFR in 2010-2015 to project fertility through 2100. Assumptions about the rest of demographic components are consistent with the 2015 WPP Revision.

## Population Projections and Comparisons with UN and IIASA projections for Africa



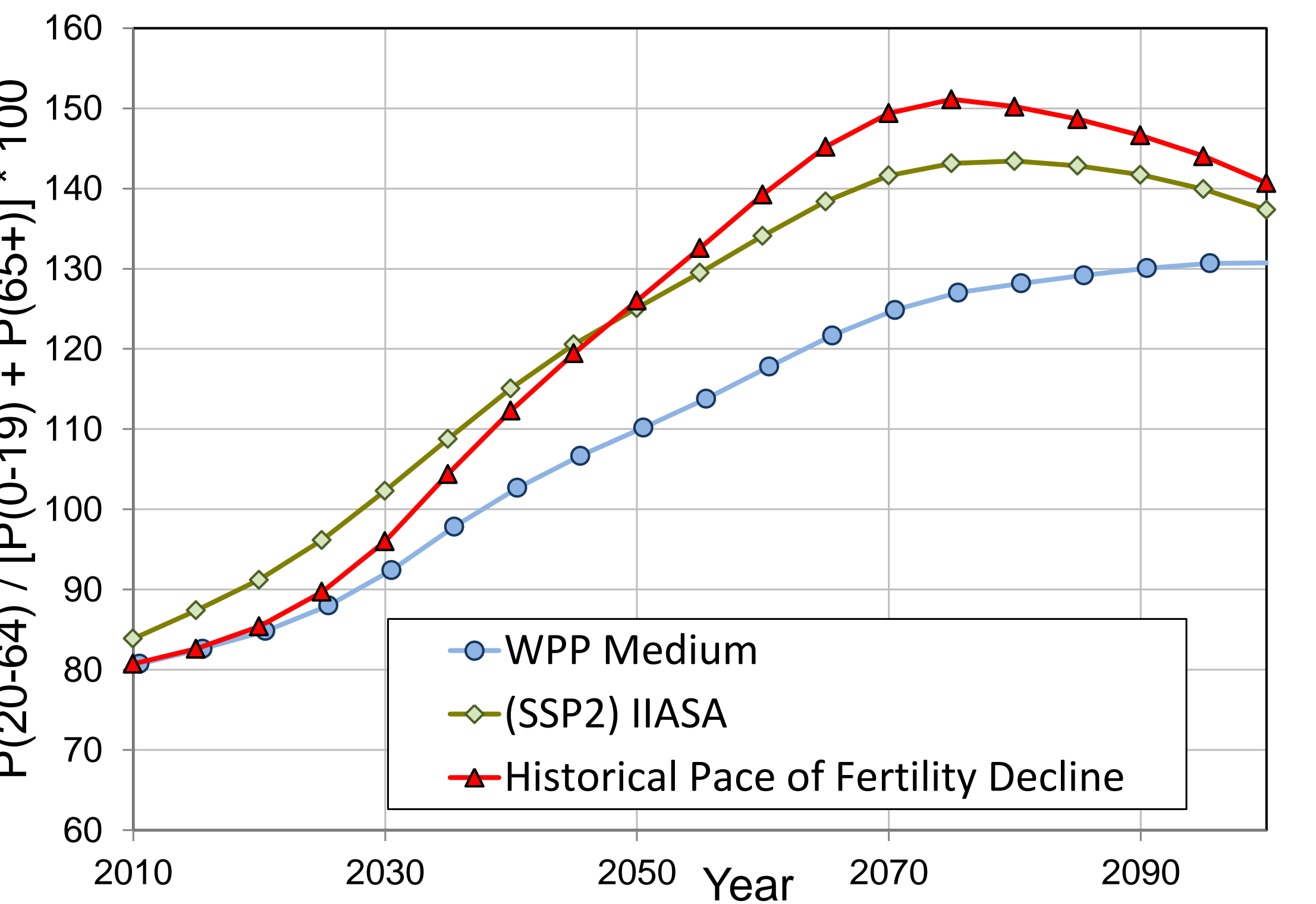
“Historical Pace of Fertility Decline” – projections produced by our method based on historical paces of fertility decline during fertility transitions.  
 “WPP Medium”, “WPP High”, “WPP Low” – UN projections, the 2015 Revision of World Population Prospects, medium, high and lower variants, respectively.  
 “SSP2 (IIASA)” – projections produced jointly by The International Institute for Applied Systems Analysis and Vienna Institute of Demography (available online via Wittgenstein Centre Data Explorer (<http://www.oeaw.ac.at/vid/dataexplorer/>)). The SSP2 scenario is described as “the middle of the road scenario that can also be seen as the most likely path for each country”.

**Total population (billion):**

| Year | Fertility Transition | 2015 WPP | SSP2 (IIASA) |
|------|----------------------|----------|--------------|
| 2010 | 1.044                | 1.044    | 1.022        |
| 2030 | 1.646                | 1.679    | 1.526        |
| 2050 | 2.273                | 2.478    | 2.017        |
| 2075 | 2.828                | 3.525    | 2.442        |
| 2100 | 2.962                | 4.387    | 2.620        |

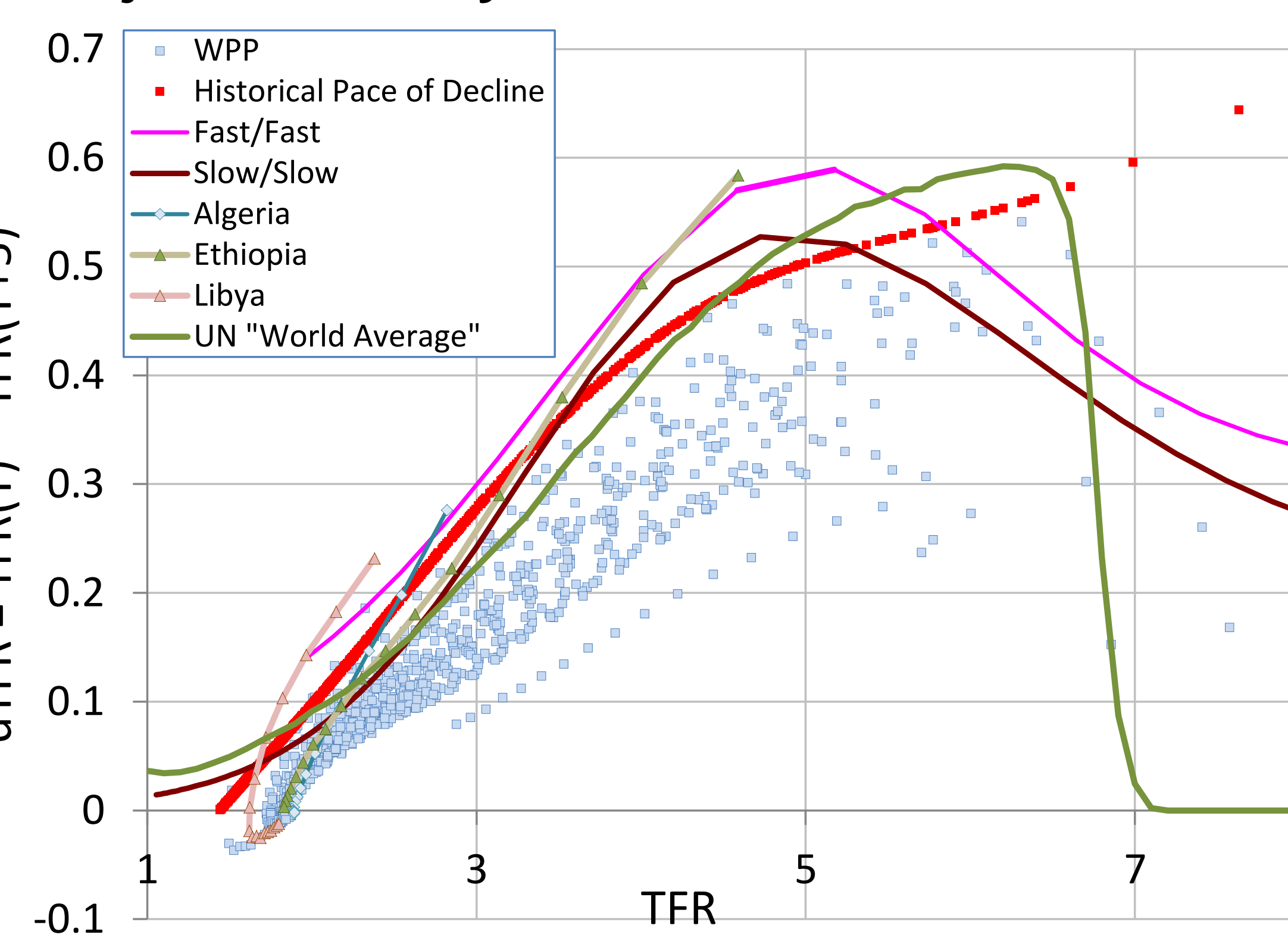
**Faster fertility declines lead to lower dependency ratios.** Excess of working age population could lead to more rapid economic gains realized through the **first demographic dividend**. For the entire projection period, 2010-2100, our and IIASA projections project higher shares of working-age population as compared with UN projections. This pattern is typical for nearly all African countries

## Ratio of Population at Age Group 20-64 to Population at Age Groups 0-19 and 65+



## Why UN projections are almost 1.5 billion higher in 2100?

### Projected Fertility Decrements for All Countries



UN projected fertility decrements are below a) the decrements estimated by our model and b) the UN “world average”. The UN model puts much more weight on the historical trends in the individual African countries rather than on the data on fertility transitions worldwide. On average, this makes UN fertility is 0.5 child higher than our projection.