

# Modeling and assessing low-fertility traps: Intergenerational feedback effects under multigenerational optimization

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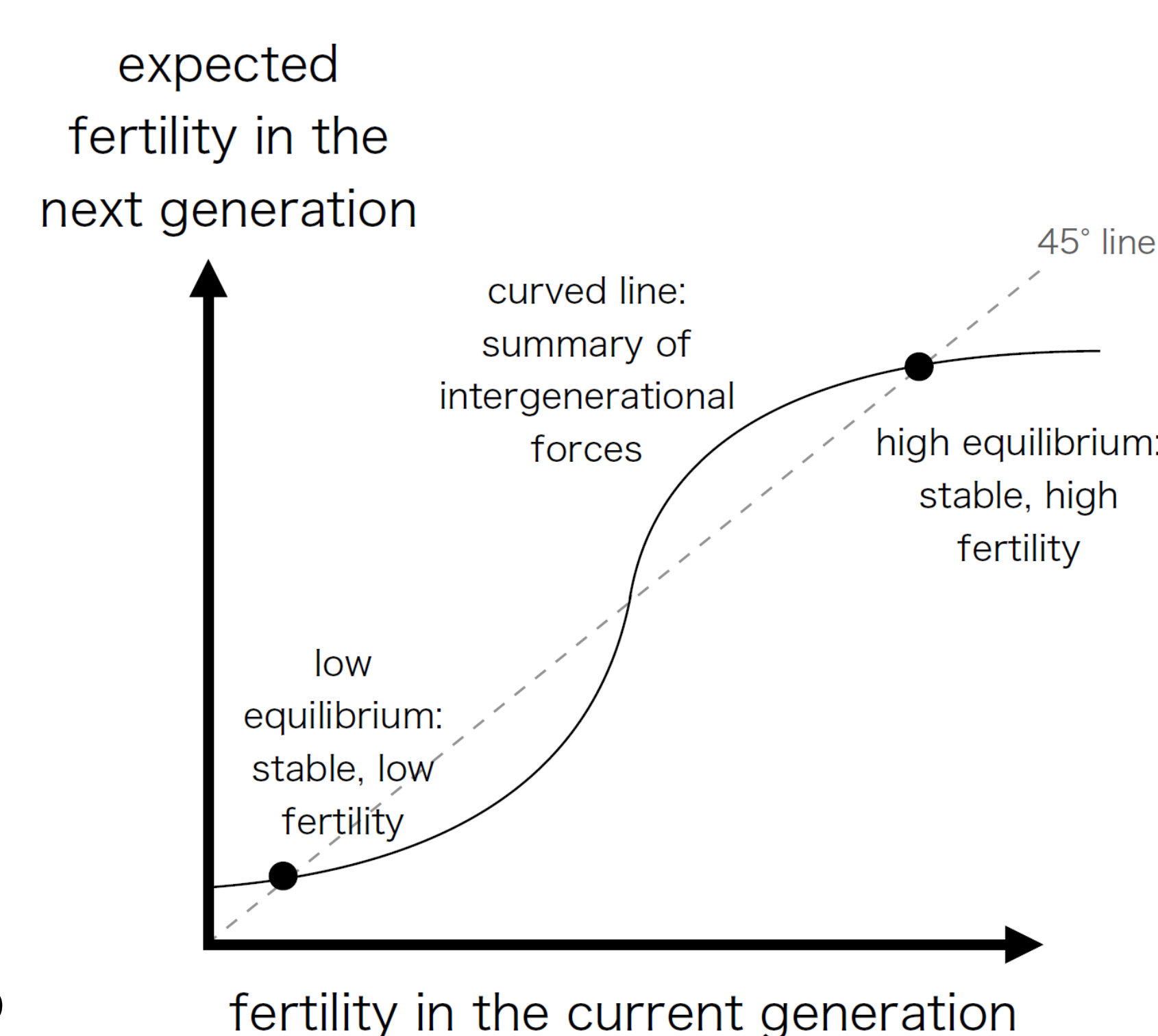
## Abstract

The low-fertility trap hypothesis is one of the most important theories about depopulation. A low-fertility trap is an intergenerational stable equilibrium, where low fertility in one generation causes low fertility in the next through strong intergenerational forces. An equilibrium is a trap if such intergenerational forces overpower intragenerational determinants. We construct a model of optimizing parents who live in a succession of cohorts. As a reduced-form proxy for intergenerational forces, we model a role for dispersion within a cohort's fertility outcomes. Because fertility is bounded below at zero, as average fertility decreases, variance decreases, too. Various mechanisms may discourage outlier fertility. Yet, we find that it is difficult for such a model to generate a low-fertility trap: intergenerational forces must be quite strong, relative to other factors that influence fertility decisions. This result is consistent with the empirical fact that fertility in low-fertility populations has not settled into stationary equilibria.

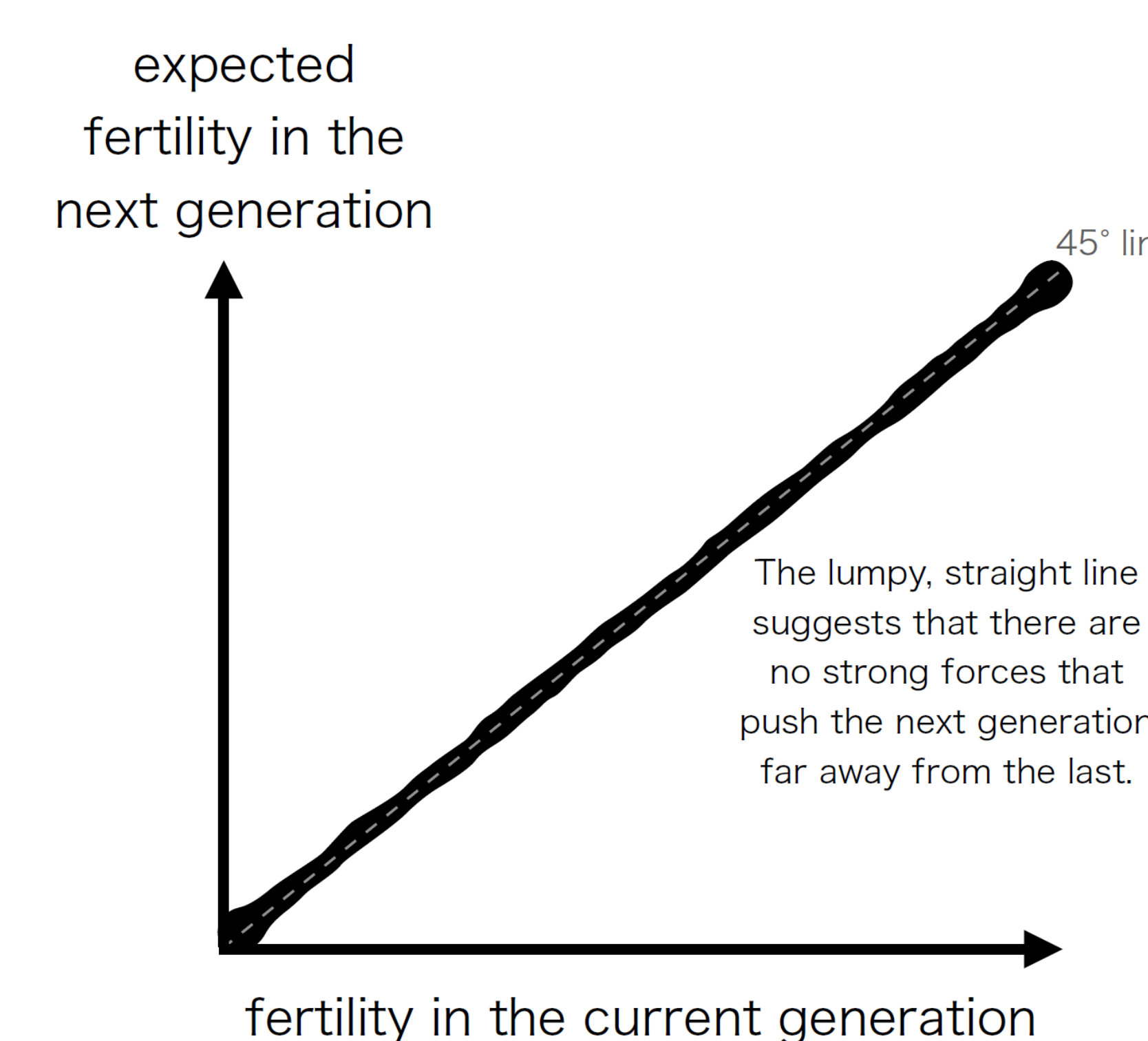
## 1. Introduction: What is a *trap*? Analogy to poverty traps

What is a “low-fertility trap” as distinct from merely low fertility? Fertility could be enduringly low without being *trapped*. Economists have defined “poverty traps” as stable equilibria under strong intertemporal forces, such that the fact that a country is poor now makes it poor in the future. Low-fertility traps can be understood analogously: **stable equilibria under strong intergenerational forces**, which can overwhelm intragenerational forces that might otherwise raise fertility above low levels. So whether a low-fertility trap exists is an empirical question about the relative strength of intergenerational forces, relative to intragenerational determinants of fertility.

(a) two trap equilibria exist:  
intergenerational forces are strong



(b) no traps exist:  
intergenerational forces are weak



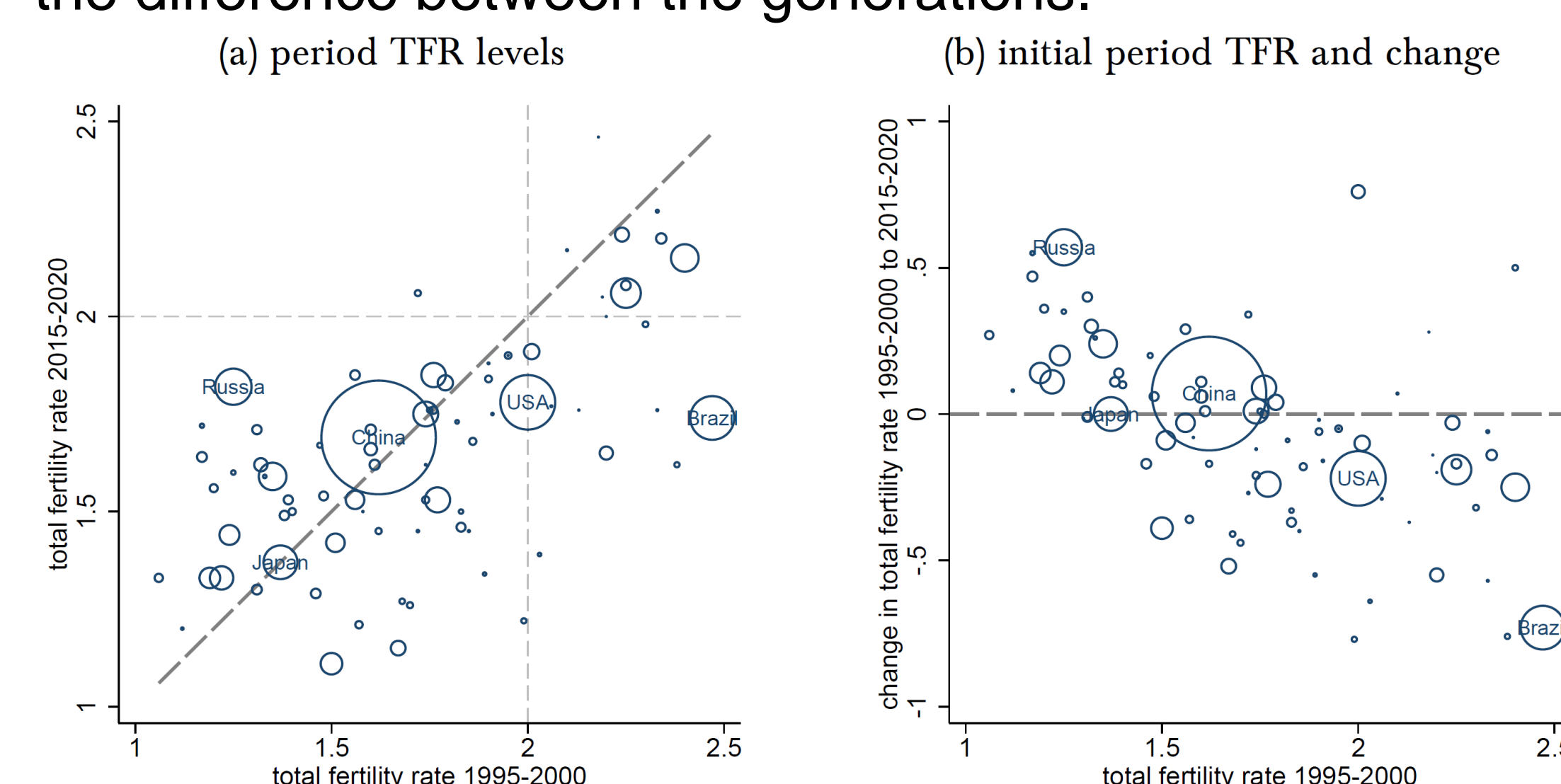
## 5. Conclusion

All leading long-term global population projections agree on projecting continued fertility decline, in individual countries and for the human population as a whole. We see no reason to disagree. But sustained, low fertility is not sufficient to conclude that there is a low-fertility trap. This is because, rather than low fertility persisting because it is trapped low due to intergenerational forces, it may be that many successive generations choose low fertility for their own reasons. After all, when conditions changed in the 20th century, intergenerational forces did not trap parents at high fertility.

In both our simple, macro-level empirical description of fertility and in our stylized micro-level model of intergenerational feedback effects, a low-fertility trap (understood as a stable intergenerational equilibrium) proves difficult to find. **Are intergenerational forces really so strong, relative to intragenerational determinants?** This is an empirical question. If we find that future generations have their fertility options open to the choices that they may find fit, then (depending upon what they choose and its consequences) this conclusion could be good news.

## 2. Macro empirical evidence

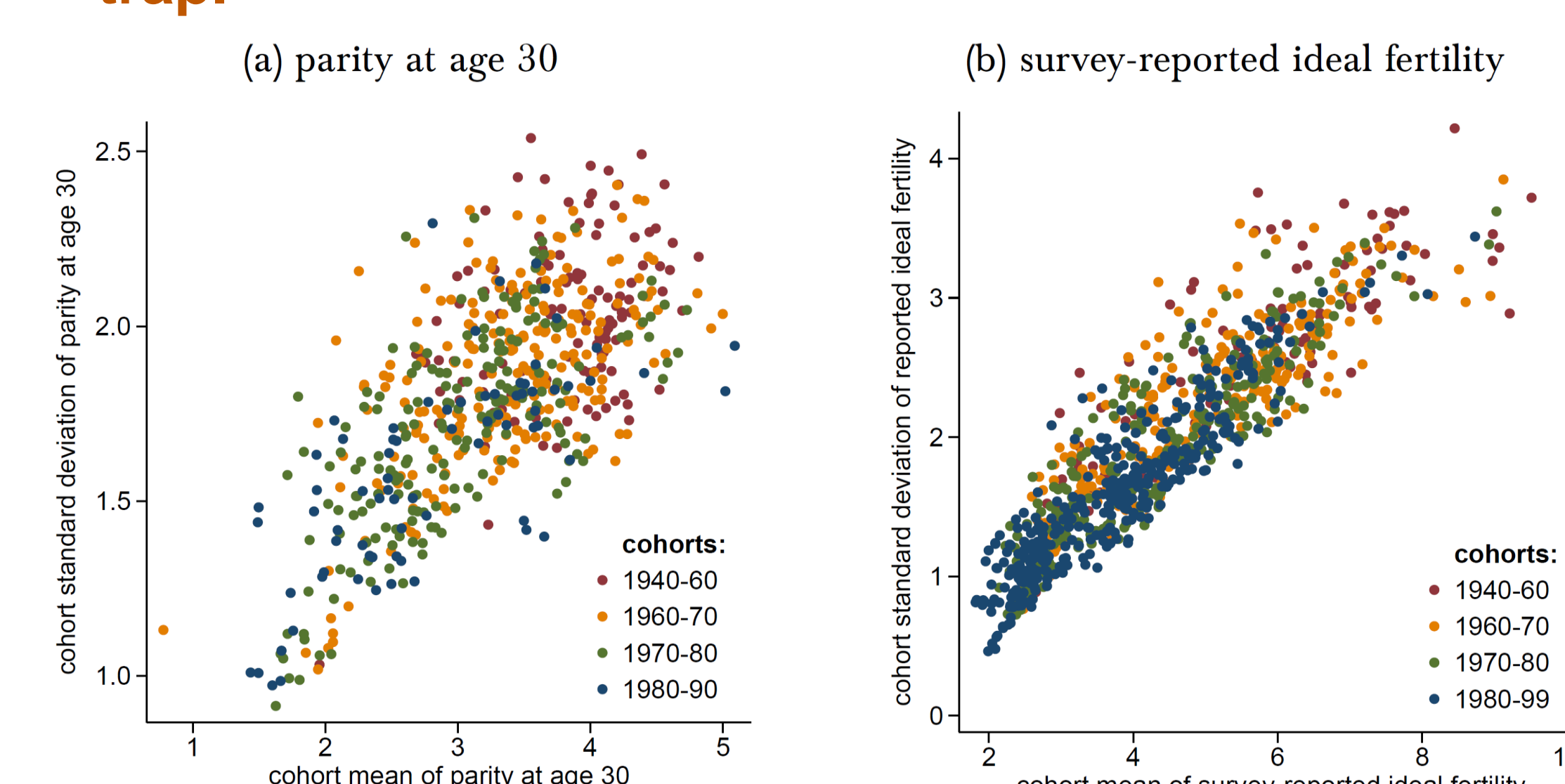
This box considers the simplest intergenerational dynamics: how does past fertility in low-fertility populations predict future fertility? Once fertility becomes low, does it remain in a stable equilibrium? The axes of Panels (a) resemble the axes in Box 1: the horizontal axis is the fertility of an earlier generation and the vertical axis is the fertility of a later generation. Panel (b) subtracts the difference between the generations.



We see little evidence in that, so far, low-fertility countries have become trapped in a stable equilibrium. We do not see, for example, that countries that started out with lower fertility were more likely subsequently to be stationary or declining. If anything, countries that started with lower fertility tended to show fertility increases. Countries that share a starting point show divergent trajectories. Of course, each country, for one possibility, may be moving on its own path towards its own unique low-fertility trap. But no low-fertility trap is apparent here.

## 3. Mechanism: Low Variance

This box presents preliminary empirical information about the reduced-form mechanism that our model uses to stand in for a broad set of intergenerational forces: the fact that low fertility levels create low fertility variance. The figures below plot actual and survey-reported ideal fertility from cohorts in the Demographic and Health Surveys (DHS) of developing countries. Each dot is a five-year birth cohort in one country (more specifically, in one DHS survey wave in one country). The horizontal axes plot average fertility in the cohort and the vertical axes plot the standard deviation of fertility within the cohort. Our purpose here is to document the clear positive slope: the variance of fertility is low in cohorts where the average is low. **Our theory model asks whether this social mechanism can generate a trap.**



## 4. Intergenerational Model

**Readers interested in the formal models of intergenerational optimization that are at the core of our paper should please consult the full text, because it is poorly suited for a visual poster.**

We demonstrate theoretically and numerically to what extent it is difficult to generate a low-fertility trap, and why that is the case. **In short, we find that deriving a stable low-fertility trap requires implausibly strong intergenerational social forces, relative to the strength of intergenerational economic, cultural, social, and other determinants of fertility.**

First, we show that it is possible for the distribution of fertility to converge to a single point if the variance drops below a certain threshold, which would only tend to happen if the average level of fertility is low. However, this argument relies on a force of social learning that becomes infinitely strong, such that all variation in fertility disappears.

Then, we consider the possibility that the fertility distribution may exhibit multiple equilibria. When average fertility is low, the equilibrium distribution may be one in which a force of social learning causes significant concentration at a given number of children. However, we find that it is not easy to generate such a trap.

## Acknowledgments



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## References

- Barro, Robert J and Gary S Becker (1989) “Fertility choice in a model of economic growth,” *Econometrica*, pp. 481–501.
- Hruschka, Daniel J and Oskar Burger (2016) “How does variance in fertility change over the demographic transition?” *Philosophical Transactions of the Royal Society B: Biological Sciences*, Vol. 371, p. 20150155.
- Kraay, Aart and David McKenzie (2014) “Do poverty traps exist? Assessing the evidence,” *Journal of Economic Perspectives*, Vol. 28, pp. 127–48.
- Lutz, Wolfgang, Vegard Skirbekk, and Maria Rita Testa (2006) “The low-fertility trap hypothesis: Forces that may lead to further postponement and fewer births in Europe,” *Vienna Yearbook of Population Research*, pp. 167–192.