Policy Concerns in an Era of Low Fertility: The Role of Social Comparisons and Intensive Parenting*

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Abstract

The global fertility rate has reached a record low, with nearly half of all countries now below replacement level. This has sparked renewed interest among policymakers and researchers alike. In this paper, we explore a novel explanation for low birth rates based on comparison motives. We show theoretically that strong comparison motives lead to high parental investments—both in time and money—and low fertility. We further show that comparison motives can amplify fertility declines driven by other forces. We provide suggestive empirical support for the role of comparison motives in explaining cross-country and within-U.S. regional variation in fertility. The resulting policy implications are different from those usually considered. Specifically, reliance on high-stakes testing and precise rankings in the education system may heighten comparison motives and thereby contribute to fertility decline. Taxing or regulating certain types of private education institutions or reforming college admissions could reduce excessive parental investment and thereby stimulate fertility.

Keywords: Fertility, Comparison Motives, Externality, Parental Investments, Education, College Admissions, High-Stakes Testing, Family Policy, Pro-natal Policies, Quantity-Quality Trade-Off

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There has been growing concern about low fertility rates in the media and among policymakers in recent years. The global fertility rate is headed towards a level below the replacement rate, which is sparking debate. Several countries are at ultra-low fertility levels—most notably South Korea, which has recently reached a fertility rate below one. Low fertility raises concerns about the sustainability of social security and other transfer systems. As a result, many governments are discussing and, in some cases, have implemented policies aimed at stimulating birth rates. But is the birth rate indeed too low? For much of the 20th century, policymakers tried to curb birth rates to increase living standards. Are we now facing the opposite problem—birth rates that are inefficiently low? And if so, why? Understanding the frictions that drive a wedge between private and socially optimal fertility is key to designing effective policy intervention.

In this paper, we explore comparison motives as a novel channel behind low fertility, an idea previously proposed and analyzed in the context of South Korea by Kim and others (2024), and apply it to a broader set of countries and settings. The idea is that (prospective) parents compare their children to other parents' children. This may be rooted in social interactions, such as concerns about relative status (Veblen 1899). Increased visibility into others' parenting—through social media, peer networks, and shifting cultural expectations—intensifies pressure to match or exceed others' investments in children's education. The rise of "Momfluencers" may have also played an important role in this context (Petersen 2023). The pressure is particularly strong in the context of college competition, where limited access to selective institutions encourages parents to out-invest their peers (Ramey and Ramey 2010), leading to an educational arms race. A related trend is the rise of zero-sum thinking where success is increasingly seen as coming at others' expense (Chinoy and others 2023).

When parents care about their children's educational outcomes relative to those of others, this can lead to high private investment in education. As a result, children become both expensive and time intensive, which naturally depresses fertility. The comparisons give rise to an externality, since parents do not internalize the effect of their educational investments on other parents' children; Kim and others (2024) refer to this as a status externality in education. This drives a wedge between the socially and privately optimal levels of educational investment. The resulting over-investment in education in turn makes children expensive and leads to inefficiently low fertility.

We begin the paper by presenting some key facts about recent fertility trends. While the global fertility rate has been persistently declining, with more than half of all countries now below the replacement level, individual country experiences differ markedly. Focusing on

high-income countries since 2000, we find four distinct patterns: flat, increasing, decreasing, and hump-shaped fertility trends. A sizable literature dating back to Becker (1960) has sought to explain the long-run decline in fertility, emphasizing factors such as the quantity-quality trade-off and rising opportunity costs of time. While these explanations are well-suited to fertility declines over the course of development, they fall short in accounting for the divergent experiences among rich countries in recent decades. More recently, a large literature has pointed to career concerns, family policies, social norms, and shifting priorities as important determinants of fertility patterns (see Doepke and others (2023), Bloom and others (2024), Kearney and Levine (2025), and Goldin (2025) for recent surveys). While clearly these are all important factors, in this paper we suggest and explore a novel determinant of fertility decisions related to comparison motives.

Alongside declining fertility rates, there has been a noticeable shift in the policy stance toward fertility—from most countries trying to curb fertility to roughly a third of countries trying to stimulate fertility (De Silva and Tenreyro 2017). But, are such government interventions justified? We take a normative perspective to discuss potential frictions that might cause inefficient birth rates. We then focus on one specific reason for suboptimal birth rates—social comparison motives—that has been largely overlooked in the fertility debate.

To that end, we present a novel model of social comparison motives and fertility choices. A key feature of the model is the quantity-quality trade-off in fertility choice, where parents choose both the number and education of children. Unlike traditional models, parents care not about education per se, but about how their children's education compares with that of other parents' children. We then derive several key results on how the comparison motive influences fertility in the model. First, when parents have strong comparison motives, parental investment is higher and fertility is lower than in an economy without such motives. Second, fertility declines driven by other forces, such as skill-biased technical change or increasing demand for child quality, are amplified by the comparison motive. Third, we find that upward comparison motives generate spillovers across income groups: for example, when only one group experiences income growth, fertility may decline in the other group as they respond to increased parental investment by their comparison group.

We then move on to empirical evidence on the role of comparison motives in fertility decisions. We begin by reviewing a few recent findings on spillover effects in parental investments across the income distribution. Next, we relate several proxies for the strength of parental comparison motives to fertility using cross-sectional data, both across countries and within the United States (U.S.). While establishing causal identification is beyond the

scope of this paper, we present various pieces of suggestive evidence. Specifically, we find that parental concerns about education and the degree of intensive parenting are negatively associated with total fertility rates across high-income countries. Using the economic connectedness index based on Facebook friendships developed by Chetty and others (2022) as a proxy for upward comparison motives, we also find that it is negatively related to birth rates across U.S. counties. Moreover, as the comparison motive can arise from college competition, we correlate various measures of college competition with birth rates and find negative relationships across regions in the U.S. We also document that competition for college access has increased over time. Notably, we find that Hispanics—who experienced the largest fertility decline—also saw the greatest increase in college enrollment over the past two decades, reaching levels comparable to those of Whites. These patterns suggest that the comparison channel may help explain recent fertility declines in the U.S.

Finally, we turn to policy implications of the comparison motive channel. Using the model, we show that when comparison motives are present, the decentralized equilibrium leads to excessive parental investment and inefficiently low fertility relative to the first-best allocation. We then show that pro-natal transfers, such as child allowances, financed by taxes on parental investments, can implement the first best by mitigating costly competition. Such policies increase fertility and improve overall welfare. Since such taxes lower education investments, one might be worried that the policy lowers human capital and, accordingly, child welfare. Yet, some private education investments may primarily serve signaling purposes rather than contribute meaningfully to human capital, as we illustrate in a model of college admission. If so, this reinforces the rationale for policy interventions that target the structure of the education system. Indeed, some countries have recently experimented with taxing private education or banning certain after-school activities altogether. For example, the U.K. recently ended its VAT tax exemption for private schools. In our view, policies that reduce education competition offer a novel avenue to improve social welfare and raise fertility. Such measures could perhaps include regulating after-school private education, reducing the reliance on high-stakes examinations, avoiding the use of precise ranking information in student evaluations, or reforming the college admissions system. Governments could also try to influence comparison motives through policies related to social media.

These policy recommendations are in contrast to a wide range of policies that have so far been implemented to address low fertility, including childcare subsidies, direct cash transfers, baby bonuses, and tax breaks. An extensive empirical literature evaluates their effec-

tiveness.[1] While these policies are generally found to increase fertility in both the short and long run, the effects tend to be modest and heterogeneous across the income distribution and policy type. Monetary subsidies—such as child benefits, tax credits, or baby bonuses—are typically found to have positive yet modest effects. Childcare subsidies, including publicly provided childcare, typically yield stronger results. Parental leave policies can also affect fertility, especially among highly educated women. However, their effects remain mixed across countries, likely due to institutional interactions with the labor market or complementary family policies. Several studies also find positive effects of housing subsidies on fertility. The costs of pro-natal policies can be sizable and estimates vary widely.[2]

The remainder of the paper is organized as follows. Section I presents recent fertility trends across countries. Section II reviews existing explanations for fertility decline and discusses normative considerations. Section III introduces our model of comparison motives. Section IV provides suggestive empirical evidence in support of the roles of comparison motive in explaining fertility patterns. Section V discusses policy and welfare implications. Section VI concludes.

I. The Facts

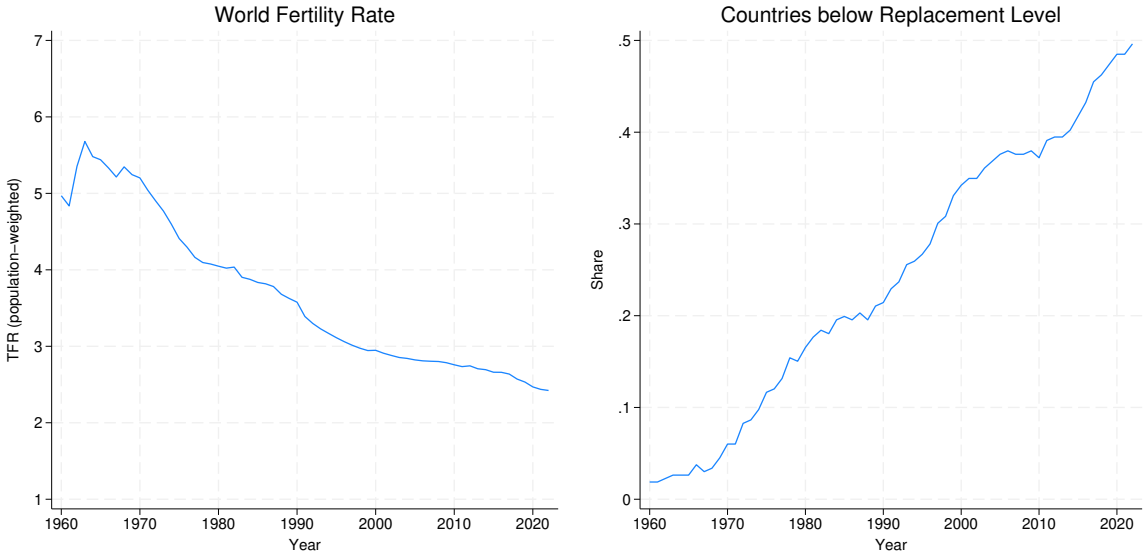
The world fertility rate is currently at a record low. For the first time in modern history, world fertility is approaching replacement fertility (the left panel of Figure 1) and it is conceivable that the world population will start shrinking in the near future. In fact, nearly half of all countries now have total fertility rates (TFR) below 2.1, the replacement level for most developed countries (the right panel of Figure 1). This is a very different situation than half a century ago. In 1980, the world fertility rate was 4 children per woman, and more than 80% of countries had fertility rates above replacement level.

Even compared to the more recent past, the fertility slowdown appears to be accelerating. This is evident, for example, in the increasing number of countries experiencing a year-over-year decline in fertility, as shown in Figure 2. Notably, while in 2007 and 2008 fewer than 60% of countries experienced a decline in fertility, today that figure exceeds 80%. Moreover,

1. See Olivetti and Petrongolo (2017), Stone (2020), Doepke and others (2023), Hart and others (2024), and Kearney and Levine (2025) for recent surveys.

2. For example, Weil (2024), based on estimates in Stone (2020), calculates that raising fertility in the U.S. from its 2020 level to the replacement level would cost around $5,300 per year per child under 18. Doepke and Kindermann (2019) suggest a cost of €25,000 to increase the birth rate from 1.6 to 1.7.

Figure 1: World TFR and Share of Countries below Replacement Rate



Notes: Left panel: Average annual total fertility rate (TFR) across all countries over time, weighted by population. Right panel: Share of countries with TFR below 2.1. Source: World Development Indicators.

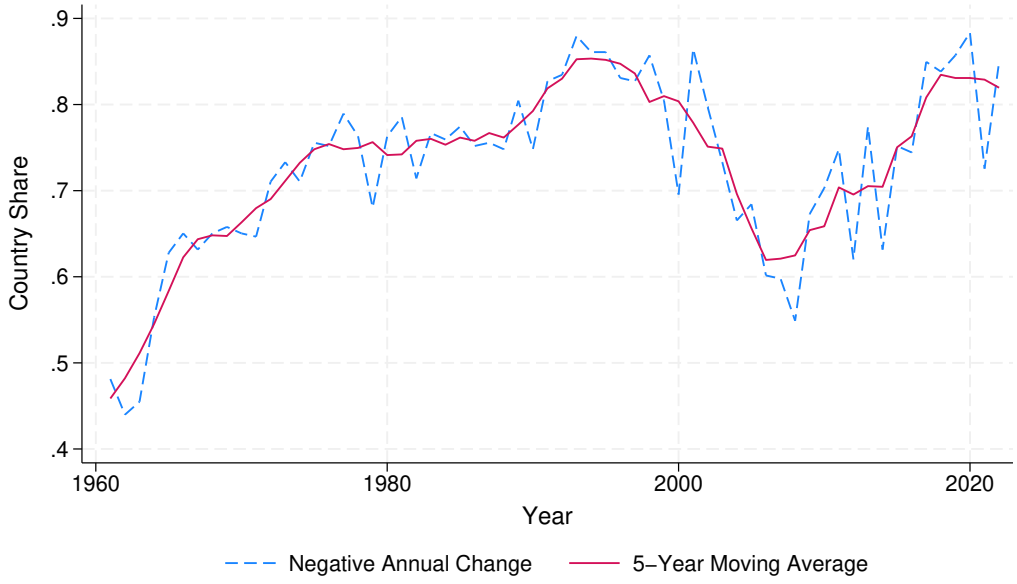
many countries have experienced a sharp drop in birth rates since the COVID-19 pandemic.[3]

Zooming in on individual countries, Figure 3 shows a remarkable convergence of fertility rates. Even Morocco—a country with more than six children per woman in the 1960s—now has a total fertility rate of just above two. Chile, another high fertility country in 1960, has a TFR of 1.54 as of 2022. In comparison, the fertility rate in the U.S. has been relatively low for a long time. For more than three decades, from 1972 to 2006, U.S. fertility had already been below replacement level. The minimum was reached in 1976 with a TFR of 1.74. It then rebounded for a while, slightly increasing above replacement level only in 2006 and 2007, and recently started declining again. The TFR in 2023 of 1.62 is a record low, but also only about a tenth of a child lower than almost 50 years earlier.

While one might interpret Figure 3 as the entire world converging to a two-child norm, note that many countries are indeed well below two children by now. For example, the TFR of South Korea in 2023 was at 0.72, i.e., well below *one* child per woman. Moreover, there is substantial heterogeneity in the fertility trends across countries in the recent past. When zooming in on high-income countries during the last twenty-five years, while a few countries have experienced a continuous decline, many others experienced a small baby boom peaking around 2008, while a third group of countries experienced an increase in

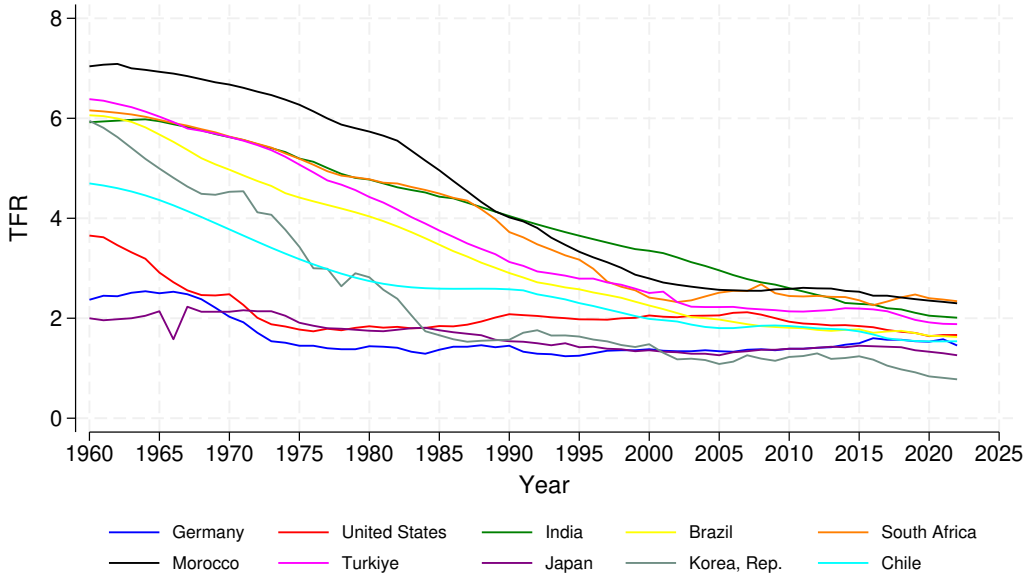
3. This is visible in Figure 4. For more details, see Figure B1 in the Appendix.

Figure 2: Share of Countries Experiencing a Decline in Annual TFR



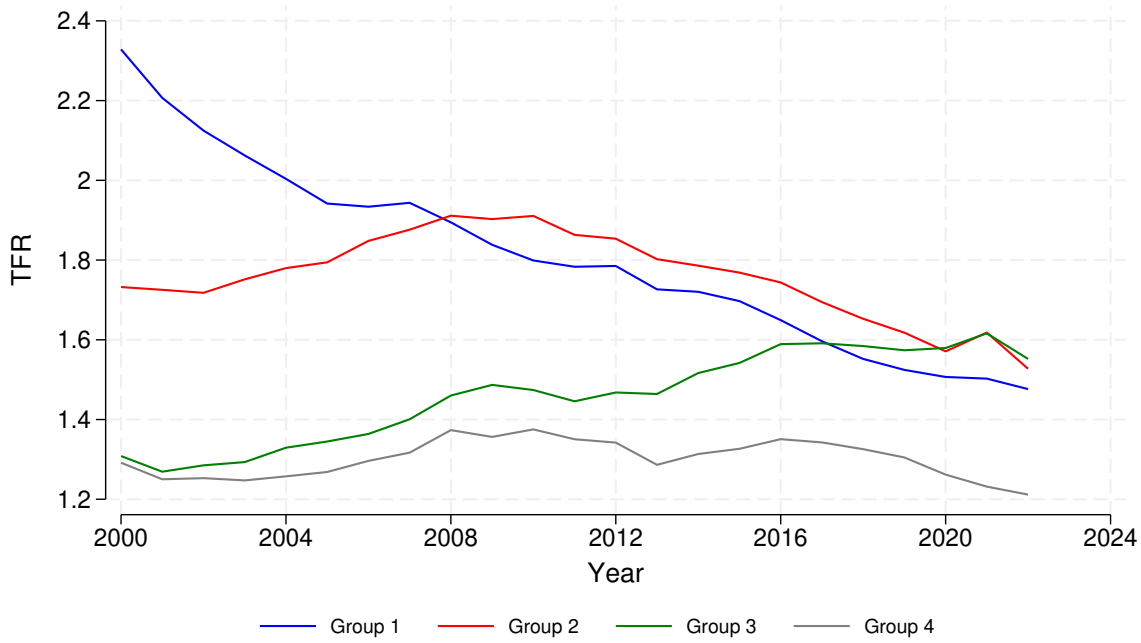
Notes: Share of countries with negative annual total fertility rate (TFR) change over time. The solid red line shows the 5-year moving averages. Source: World Development indicators.

Figure 3: TFR since 1960 in Selected Countries



Notes: Total fertility rate (TFR) across selected high-population countries over time. Source: World Development Indicators.

Figure 4: Average TFR in Four Groups of High-income Countries



Notes: Time series represent the unweighted average TFR trend between 2000 and 2022 of all countries belonging to a group. Only high-income countries with a population larger than 5 million in 2020 are included. Countries in Group 1 are: Chile, South Korea, Singapore, Saudi Arabia, United Arab Emirates, and the U.S. Countries in Group 2 are: Australia, Belgium, Canada, Denmark, Finland, France, Netherlands, New Zealand, Norway, Sweden, and the U.K. Countries in Group 3 are: Austria, Bulgaria, the Czech Republic, Germany, Hungary, Romania, Russia, the Slovak Republic, and Switzerland. Countries in Group 4 are: Italy, Spain, Portugal, Poland, Greece, Hong Kong, and Japan. Individual countries are displayed in Appendix Figure B1. Data Source: World Development Indicators.

fertility over most of that period and yet another group of countries saw a relatively flat fertility trends. This heterogeneity is visually illustrated in Figure 4, where we grouped high-income countries into four groups based on their TFP evolution between 2000 and 2022.[4] The figure reveals that the recent rapid decline in the world fertility rate is not mainly driven by high-income countries. In fact, only four high-income countries experienced a sizable fertility decline since 2000, namely the U.S., Chile, Singapore, and South Korea. Many countries in Eastern Europe and the German-speaking area saw fertility increase over this time period—from an average of 1.31 in 2000 to 1.55 in 2022. Several Scandinavian and Anglo-Saxon countries, on the other hand, went through a mini baby boom since 2000, concluding with post-pandemic TFRs that are below the pre-boom years. Interestingly, the

4. Fertility trends for all countries separately are shown in Figures B1 in the Appendix.

peak of the mini baby boom roughly coincided with the financial crises. A final group of largely Southern European countries experienced largely stable fertility rates over the same time period.

Given these very different experiences over the last two decades, it does not seem promising to us to look for the *one* explanation for fertility declines around the world, nor for the *one* policy solution either. Rather, it seems more likely that many different factors are responsible for the varying experiences across (rich) countries. In this paper, we present and analyze one such factor, comparison motives, that has been neglected in the debates so far. Before laying out the theory and presenting evidence for our hypothesis, we start with a review of existing explanations for fertility declines. We will also discuss the need for policy interventions from a normative point of view.

II. Existing Explanations for Low Fertility and Normative Considerations

In this section, we will first discuss existing explanations for fertility declines over time. Since many excellent surveys on these topics exist, we will largely refrain from citing individual papers and instead refer the reader to these surveys (e.g. Feyrer and others (2008), Doepke and others (2023), Bloom and others (2024), Weil (2024), Kearney and Levine (2025), Gobbi and others (2025)). Second, we will take a normative perspective and discuss existing rationales for policy intervention.

II.A. Existing Explanations for Fertility Decline

Historically, total fertility rates were around six or seven children in most countries. The historical fall from above six to under three started in the late 19th century in most of today's rich world and is usually explained as a combination of several factors. Rising returns to education leading to an increased demand for child quality and accordingly diminished demand for quantity is usually considered the most important factor. Another factor is the decline in child mortality, which reduced the need for precautionary childbearing and accordingly reduced fertility. Further, the rise in women's labor force participation increased the opportunity cost of their time and thus further depressed fertility.[5]

5. However, the bulk of the historical fertility decline occurred before married women started entering the labor force in large numbers.

The introduction of social security systems is another factor which diminished the need for (own) children as old age support. The invention of modern birth control methods facilitated the implementation of lower demand for children but is usually not considered the main driver. Similarly, falling marriage rates and later marriage ages seem to be more a result than a driver of lower demand for children.[6] In some countries, population control policies played an important role in accelerating fertility declines—most notably China with its one-child policy introduced in 1979 (and its predecessor the later-longer-fewer (LLF) policy in the 1970s), South Korea with a national family planning campaign launched in 1962 and active through the 1970s and 1980s, and India which became infamous for forced sterilizations. However, many countries without such policies saw similar declines in fertility, casting some doubt on the importance of the policies. For example, France, the first country to go through the demographic transition, never had any population control policies.

Leaving the historical fertility decline aside, much research has tried to understand the more recent declines and the causes behind the sizable cross-country variation in fertility even among OECD countries. Here, the convergence of aspirations of men and women plays an important role. Today, most women want a career and a family, just like men. Thus, the ease with which a career can be combined with a family becomes crucial. Several factors facilitate combining a career with children. First, family policy, and in particular the public provision of childcare plays an important role. When high-quality childcare is available and relatively cheap, women are more willing to have children. Secondly, the extent to which fathers are involved in raising children matters. It has been documented that in countries where fathers take on a larger share of child-rearing, fertility is higher. Thirdly, social norms about a mother's role are an important factor. In countries where the norm is that mothers of small children should not be working, many women choose not to have children at all. Finally, labor market institutions play a role as well. For example, in countries where re-entry after maternity leave is difficult, women are reluctant to give up stable jobs to have children. In sum, countries where these four factors facilitate combining a career with family life have higher birth rates than countries where policy, norms, husbands, and labor markets pose an obstacle for women to have both.

A final set of explanations is related to the cost of children. In particular, the rising costs of housing have been pointed out as an obstacle to having children (Dettling and Kearney 2014). Also, parenting has become more time-intensive, making children more costly. Of

6. Although, very recently, it has been argued that the rise of big tech and social media has made people less interested in marriage and family life and hence has contributed to declining birth rates (Evans 2024).

course, the amount of time parents invest in their offspring is largely a choice, so it may seem a bit puzzling why parents choose such large time and monetary investments and simultaneously complain that it is too costly. We will come back to this point later.

One might argue that children are simply an inferior good, and as people get richer, they opt for expensive cars and toys, travel and theater, and more leisure, all at the expense of children. Thus, the decline of world fertility may simply reflect economic development and shifting priorities. If so, falling birth rates do not necessarily provide a clear rationale for government intervention. Nonetheless, the left panel of Figure 5 speaks against this interpretation, showing that, at least in the U.S., the ideal family size has been close to constant at 2.5 children since the 1970s.[7] The gap between the ideal and the actual number of children has been sizable for a while and has specifically increased since 2007, precisely the year of the renewed fertility decline. Of course, survey questions about the ideal family size are somewhat difficult to interpret, but we do find it striking that there is a large and growing discrepancy between desired and actual family size. It clearly suggests that costs or constraints have been changing rather than social norms about what makes an ideal family.

II.B. Normative Considerations

Throughout most of the 20th century, policymakers were primarily concerned with high fertility rates and overpopulation.[8] However, since the early 21st century, the policy stance on fertility has remarkably shifted (De Silva and Tenreyro 2017). While up until the 1990s governments in most countries tried to curb fertility rates with the goal of raising standards of living, since the early 2000s, the number of countries encouraging fertility has grown tremendously. As shown in the right panel of Figure 5, almost 30% of countries now implement pro-natal policies, compared to only 10% in 1980.[9] What can explain this switch from concerns about too many babies to worries about too few? And are the worries justified?

Consider a simple Solow model with population growth.[10] The higher population growth, the lower is GDP per capita in such a model. Restricting fertility makes sense in that it in-

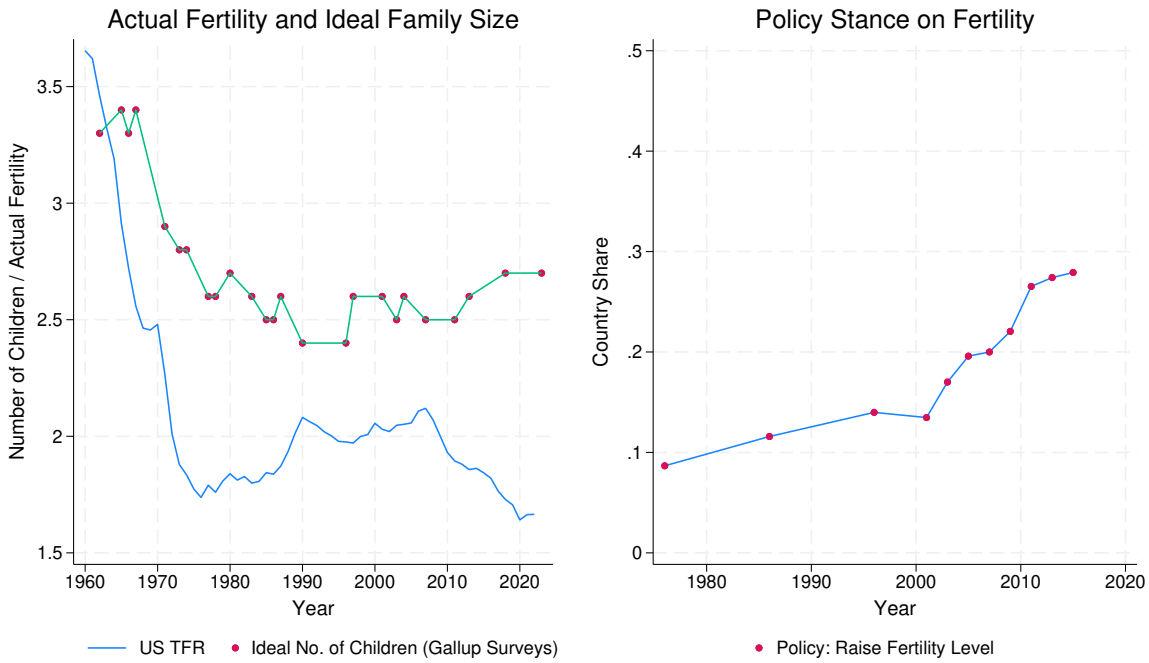
7. A desired fertility rate around two seems to be the case in many countries today. The UN asked men and women in 14 countries about their ideal number of children and in almost all cases the mode answer was two children (UNFPA 2025, Figure 8).

8. The book *The Population Bomb* by Paul R. Ehrlich, published in 1968, received considerable attention at the time.

9. The share is calculated as the number of countries with a policy stance to "raise" the fertility level, divided by the total number of countries in the UN World Population Policies database. These were 164 countries in 1986 and 197 in 2015.

10. See Appendix I.A for a formal derivation.

Figure 5: Actual Fertility vs. Ideal Family Size in the U.S. and Policy Stance on Fertility



Notes: Left panel: Actual total fertility rates and average ideal family size in the U.S. Data on ideal family size comes from Gallup polls (Brenan 2023). Right panel: Share of countries with a policy stance on fertility to raise fertility levels. Source: UN World Population Policies Database.

creases capital per worker and hence output per person.[11] The Solow model, however, makes no distinction between population and workers. By now, the retired population makes up a sizable fraction of total population, leading to a gap between GDP per capita and GDP per worker. For example, the old-age dependency ratio, defined as the ratio of people older than 64 to those aged 15-64 in the U.S. has increased from around 18% in 2006 to more than 26% in 2023; in Germany the ratio was at 36% and Japan at a staggering 50% in 2023 (World Bank 2025). Adding a retirement phase to the Solow model, it is easy to see that GDP per capita can actually fall as population growth falls. The reason is that falling fertility not only increases capital per worker, but also changes the age composition of the population.[12] Lower fertility increases the share of retired individuals in the economy. Since most countries have some version of a PAYGO social security system, this leads governments to be

11. There is no human capital in the Solow Model, but a similar logic applies. Essentially all models of the demographic transition are based on a trade-off between the quantity and quality of children so that population declines go hand in hand with increases in human capital per capita and hence economic growth.

12. Falling fertility is an important factor behind population aging, as is higher life expectancy and changes in migration, see e.g. Weil (1997).

worried about the financing of their pension systems and other parts of the transfer system that redistribute from younger to older people (e.g., healthcare and long-term care). The concern about the pension system seems the main reason why many governments are alarmed by low birth rates and many have switched to pronatal policies. This is not a new concern though. Many governments have been concerned about the sustainability of the pension system for at least the last two decades (e.g., Reznik and others (2007)) and much research has been devoted to the link between low fertility, population aging, and social security systems since then (Weil 1997; De Nardi and others 1999; Lee and others 2014).

But is the financing of the social security system really a valid reason to pay large sums of money trying to stimulate the birth rate? Clearly, there are many ways to adjust the pension system—such as increasing retirement age, encouraging immigration, or decreasing the payouts. Further, what is missing in the simple Solow model logic is that children are costly and that parents choose fertility taking these costs into account. Hence, it is not obvious that achieving a higher fertility rate through birth subsidies is necessarily welfare-improving. Are parents somehow making the wrong decisions? To answer this question, we suggest to use the tools of welfare economics and ask what frictions and market failures may lead private fertility decisions to be different from those that are socially optimal. In other words, what reasons lead the first welfare theorem to fail in the context of fertility decisions? Of course, there is a large literature both in philosophy and economics on the appropriate welfare concepts with endogenous fertility. Rather than providing a full discussion here, we would like to refer the reader to the summaries in Doepke and others (2023, Section 7) and Kim and others (2024, Section 6). While much of our discussion implicitly adopts the notion of $\mathcal{A}$-efficiency proposed in Golosov and others (2007), the frictions discussed below would generate a wedge between private and social optima using a wide variety of welfare concepts.

A first obvious friction is that a clean environment is a public good. A larger population means more polluters, and hence overpopulation and climate change can arise.[13] This is likely what the Ehrlichs had in mind when they wrote their book *The Population Bomb* in the 1960s. Also, climate concerns are sometimes mentioned as an important reason for choosing not to have children. This would be an argument, however, for birth control policies, not for birth-promoting policies.

13. See the technical appendix of Golosov and others (2007) for a formal derivation of how pollution leads to inefficiently high fertility. To correct the inefficiency, both a tax on pollution and also a child tax are necessary. The authors also show that the same logic does not apply to other finite resources such as land. Key for private fertility decisions to be inefficient is the presence of an externality.

What type of frictions could lead parents to want fewer children than what is socially optimal? One reason is missing property rights. The main benefit from having a(nother) child goes to the child herself, as she will likely earn a wage that she can use for her own consumption. The costs, on the other hand, are largely borne by the parents. There is no contract a parent can write with an unborn child where the child promises to repay the parent for the cost of having her. To overcome this friction, at least theoretically, governments can either introduce a pension system tied to the number of children or, alternatively, pay fertility subsidies financed by government debt (Schoonbroodt and Tertilt 2014).

As mentioned before, a different reason for low fertility is related to gender roles and the fact that for women child-rearing often clashes with their advancements in the labor market, especially when social norms favor traditional gender roles.[14] But is this a reason for policy intervention? Maybe yes. Fertility may be inefficiently low due to a lack of commitment between spouses. If women bear most of the costs of bearing and rearing children—costs in terms of their physical health but also in terms of forgone wages and forgone human capital accumulation—and men cannot commit to sufficiently compensating women for these costs, then women may veto having (additional) children, even if they would like to have them in a first-best world (Doepke and Kindermann 2019). One way to address such a commitment problem, at least partially, is through divorce law and the strict enforcement of child support payments. While full commitment could perhaps be achieved through prohibitive divorce costs, a law that effectively prohibits divorces clearly has other drawbacks. As an alternative, policymakers could consider how fertility-promoting policies affect mothers specifically. A simple monetary transfer at birth (e.g., in the form of a tax deduction) will benefit both spouses equally. Childcare subsidies, on the other hand, will likely disproportionately affect mothers. Doepke and Kindermann (2019) also consider targeting monetary child subsidies only to one spouse and find that, at least in theory, targeting subsidies to mothers (and only from higher order births onwards) is the most cost-effective way to stimulate births.

Another point that has been stressed recently is that innovation may be a function of the number of people.[15] Since parents do not take such knowledge spillovers into account when choosing to have children (or not), privately chosen fertility rates will likely be below the social optimum. Jones (2022) argues that we might be headed towards stagnation as ideas stagnate with declining populations. Fertility decline also leads to an aging workforce

14. This has been emphasized by demographers and sociologists for a long time, e.g., see work by Mary C. Brinton. See also Goldin (2025).

15. Interestingly, this point had already been made by Keynes about England in the 1920s (see Zimmerman (1989)).

which may also directly impact productivity, see e.g. Maestas and others (2023). However, this argument by itself does not seem to include an externality and hence, in our view, is not a justification for pronatal policies.

A different argument for pronatal policies is that a large population serves national interests, particularly in maintaining political and military power. Relatedly, larger populations increase domestic market size, which might matter in times of trade wars. While these might be valid political reasons for pronatal policies, they are not grounded solely in economic reasoning.

Finally, parents often cite housing costs, high education costs, and other expenses related to children as a major impediment to having (additional) children. But are high costs of children a reason for subsidizing births? At first sight, saying one would like more children if they were cheaper seems quite parallel to, e.g., saying one would like more cars if they were cheaper. Without a particular friction that artificially inflates the cost of children, high costs seem no compelling argument for subsidizing births. However, as we will argue in the next section, there might indeed be reasons to believe that due to a particular externality children are more expensive than they should be from a social standpoint.[16]

III. A Novel Explanation for Low Fertility: Social Comparisons in Children's Education

We now suggest a novel reason contributing to low fertility rates: comparison motives. The idea is that parents compare their children's educational outcomes with that of other people's children, leading to an arms race in educational investments. The resulting high educational expenses make children costly and lead parents to have fewer or even no children. In this section we present a model to formalize the idea, while Section IV provides empirical evidence consistent with the model's predictions.

The framework builds on Kim and others (2024), who argue that such motives lead to excessive private educational spending and ultra-low fertility in South Korea. In East Asia, comparison motives are often related to Confucianism and the culture of interdependence (Wong and Ahuvia 1998). However, comparison motives are increasingly relevant in Western societies as well. They may be connected to the rise of zero-sum thinking, which Chinoy

16. Of course, there may also be other frictions that distort the costs of having children. In particular, one could think of frictions related to the housing market, such as high transaction costs, zoning laws, property taxes, or rent regulation that cause housing to be inefficiently costly, which may affect fertility.

and others (2023) document as being especially prevalent among younger generations in the U.S. The growing visibility of others' parenting behavior—facilitated by social media and peer networks—further intensifies the pressure on parents to gauge their success by their children's educational outcomes. So-called "momfluencers" play an important role in shaping these pressures (Petersen 2023). Moreover, limited access to elite colleges creates a competitive environment where parents naturally place value on investing more than their peers. Therefore, we argue that such comparison motives are not unique to Korea or East Asia but are increasingly relevant in other contexts, including the U.S.

To this end, we begin with a baseline homogeneous-agent model that is simple and analytically tractable, where parental investment is captured by time inputs. This is consistent with empirical evidence highlighting the importance of parental time in the U.S. (Guryan and others 2008; Ramey and Ramey 2010) and other developed countries.[17] We then extend the framework by introducing a minimal degree of heterogeneity and allowing for two forms of parental investment—time and money. This extended model enables us to address issues related to inequality and social interactions, while also incorporating monetary investments, which are becoming increasingly important across countries, especially in East Asia.

III.A. Baseline Model

We first consider an economy comprised of a continuum of identical parents. Like most theories of fertility choice, our model features a quantity-quality trade-off. Each parent derives utility from the number of children, weighted by ω_n, and from the quality of each child, weighted by ω_h. We capture comparison motives by assuming that parents derive utility from their child's human capital h *relative* to a benchmark level $\tilde{h}$.[18] The benchmark level is pinned down by the choices of other parents in equilibrium, as detailed below. Thus, while the benchmark is an equilibrium object, individual parents take $\tilde{h}$ as given, just like prices in a standard competitive equilibrium.

A parent then chooses consumption c, fertility n, and per-child investments x, taking $\tilde{h}$ as

17. We document the increase in time parents spend with their school-age children in a selection of countries in Figure 8 in the next section.

18. It is also possible that comparison motives operate on the inputs of the human capital production function. Specifically, parents may benchmark how much time they spend with their children against other parents. This would be an interesting extension that might be particularly relevant in Western contexts.

given. Formally, individual parents with productivity z, solve:

$$\max_{c,n,x} \left[\ln c + \omega_n \ln n + \omega_h \ln \left(h - \chi \tilde{h} \right) \right] \tag{1}$$

$$\begin{aligned} \text{subject to} \quad c &= (1 - \lambda n - xn)z & (2) \\ h &= h_0 + x & (3) \\ \lambda n + xn &\in [0, 1] & (4) \\ c, n, x &> 0, & (5) \end{aligned}$$

where $\chi \geq 0$ governs the strength of the comparison motive and $\lambda > 0$ denotes a fixed time cost per child. The human capital production function features a baseline level $h_0 \geq 0$ which can be augmented by parental time with their children. The total time endowment and the productivity (or wage) z are normalized to 1.

Each parent takes the benchmark human capital $\tilde{h}$ as given when making their own choices. In equilibrium, the human capital implied by the individual choices x must be consistent with this benchmark. In our baseline model with identical parents, the benchmark coincides with average human capital, so the equilibrium condition is $\tilde{h} = h$. Later, when we add heterogeneity, the benchmark will be defined more generally.

The Role of Comparison Motives for Investment and Fertility Choices

Solving the model, the equilibrium time investment and fertility choices are:

$$\begin{aligned} x^* &= \frac{\lambda \omega_h}{(1 - \chi)\omega_n - \omega_h}, & (6) \\ n^* &= \frac{\omega_n - \omega_h/(1 - \chi)}{(1 + \omega_n)\lambda}. & (7) \end{aligned}$$

The partial derivatives with respect to χ indicate that a stronger comparison motive increases time investment per child, x^*, while reducing fertility, n^*.[19] This result highlights that comparison motives can lower childbearing by intensifying pressure to invest in each

19. In our model, fertility is a continuous choice, and hence it does not distinguish between the extensive and intensive margins of fertility. However, as Kim and others (2024) show in a model that explicitly allows for childlessness, the same logic applies to the extensive margin as well. In reality, a sizable number of couples choose to remain childless, perhaps resulting from the fact that they cannot afford the type of child they would like to have.

child, leading to the following implication:

Result 1. *An economy with a stronger comparison motive (higher χ) will exhibit higher parental investment and lower fertility, all else equal.*

As discussed in Section I, fertility rates have declined globally in recent decades, with especially sharp drops in some countries. What role might comparison motives play when other economic or social forces are already driving fertility downward? A leading explanation for the long-run decline in fertility is the quantity–quality trade-off: rising living standards have increased parental demand for child quality relative to quantity. In our model, such a shift can be captured by an increase in ω_h, which reflects stronger preferences for child quality. In the model, equilibrium fertility decreases in response to a higher ω_h:

$$\frac{\partial n}{\partial \omega_h} = -\frac{1}{(1+\omega_n)(1-\chi)\lambda} < 0, \tag{8}$$

illustrating the standard quantity–quality trade-off. More importantly, we find that:

$$\frac{\partial^2 n}{\partial \chi \, \partial \omega_h} = \frac{-(1+\omega_n)\lambda}{\left[(1+\omega_n)(1-\chi)\lambda\right]^2} < 0, \tag{9}$$

which implies that the fertility-reducing effect of increased concern for child quality is amplified in the presence of stronger comparison motives. That is, comparison motives intensify the pressure to invest per child, further reducing fertility when ω_h rises. The reason is that when ω_h rises, all parents invest more in their children, so that with active comparison motives the benchmark level also rises. This gives an additional reason for increasing the investment, making children even more costly and thus fertility declines by more than in an economy without comparison motives ($\chi = 0$).

Result 2. *Comparison motives amplify fertility declines that are driven by rising concern for child quality.*

III.B. Adding Heterogeneity and Money Investments

We now add heterogeneity to the model by considering two types of (prospective) parents, indexed by productivity $z \in \{z_l, z_h\}$, each comprising half of the population. Following Kim and others (2024), we now assume *upward comparison motives* by imposing the equilibrium condition that the benchmark $\tilde{h}$ equals the human capital level of high-type children: $\tilde{h} =$

h_h.[20] We further expand the model by adding monetary investments into children, which seem particularly relevant in East Asia. We denote the monetary investments as e and assume the following human capital production function

$$h = h_0 + (zx)^{\alpha_1} e^{\alpha_2}. \tag{10}$$

The parameter $\alpha_1 \geq 0$ captures the productivity of parental effective time inputs, scaled by z, and the parameter $\alpha_2 \geq 0$ governs the productivity of monetary investment. To replicate the empirically observed positive income gradients in parental time investment (Guryan and others 2008; Ramey and Ramey 2010), we assume that time inputs are more productive for high-income types and that time and monetary investments are complementary in generating child human capital (Yum 2023). The budget constraint for a parent of type z in the augmented model is

$$c + en = (1 - \lambda n - xn)z. \tag{11}$$

In this augmented model, each parent of productivity type z chooses consumption c, fertility n, and per-child investments in time x and money e, taking the human capital production function (10), the budget constraint (11), and $\tilde{h}$ as given.

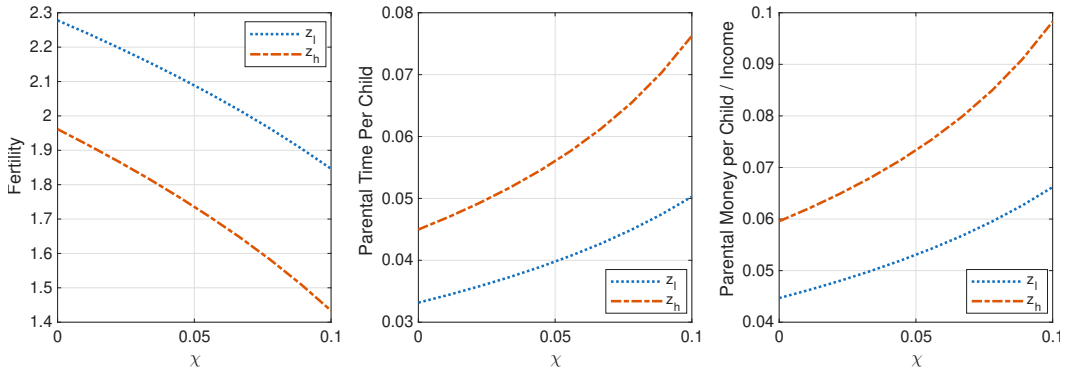
The equilibrium, which determines the benchmark human capital level and the corresponding individual choices, is defined as follows. Each individual parent takes the benchmark human capital $\tilde{h}$ as given. The child human capital outcomes of type z_h—determined endogenously as a function of $\tilde{h}$—must be consistent with this benchmark. That is, $\tilde{h}$ must coincide with the human capital outcome it is based on. Given the augmented model is less tractable than the baseline model, we rely on numerical solutions for this model.

We now revisit the role of comparison motives in this extended model, where comparisons are *upward*, parents are heterogeneous and have two forms of investment possibilities (time and money) in their children. Figure 6 shows that a stronger upward comparison motive (raising χ from 0 to 0.1) lowers fertility for both low- and high-type parents, and substantially increases parental investments per child in both time and money (expressed relative to income), naturally extending Result 1 from the homogeneous-agent economy with only time inputs.

Result 3. *Heterogeneous-agent economies with stronger upward comparison motives (higher χ) exhibit higher parental time and money investments and lower fertility across all parent*

20. See Ferrer-i-Carbonell (2005) for empirical evidence supporting upward-looking comparison motives.

Figure 6: Heterogeneous Effects of Upward Comparison Motives



types, and therefore in the aggregate.

Skill-Biased Technical Change and Fertility

The U.S. economy has experienced sustained growth over the past several decades. A widely accepted explanation is that this growth has been largely driven by high-skilled labor, a phenomenon known as skill-biased technical change (SBTC). SBTC refers to technological advancements that disproportionately raise the productivity—and thus the wages—of skilled workers relative to unskilled workers. This mechanism has been extensively studied in both the labor economics literature (e.g., Card and DiNardo (2002)) and the macroeconomics literature (e.g., see the review by Violante (2008)).

We now use our extended model to examine the implications of SBTC for fertility dynamics and the role of comparison motives. We analyze how an increase in the relative wages of high-skilled parents—modeled as a rise in z_h relative to z_l—affects fertility and child investment decisions across the skill distribution, and how these effects are shaped by upward comparison motives.

Specifically, we assume that only high-type individuals experience wage growth, while the wage of low-type individuals remains constant.[21] That is:

$$z_l = \bar{z} \tag{12}$$

$$z_h = \bar{z} + \delta_z, \tag{13}$$

21. In Appendix Section I.B, we also consider a set of exercises involving a mean-preserving spread that affects both types in opposite ways, to examine how comparison motives influence the relationship between inequality and fertility.

where $\bar{z}$ is a baseline level. We then examine the model's implications by varying $\delta_z \in [0.1, 0.3]$. To understand the role of the comparison motive in shaping how SBTC affects equilibrium outcomes, we present results from two model versions: one without the externality ($\chi = 0$), and one that incorporates the comparison motive ($\chi = 0.1$).[22]

The top panels of Figure 7 plot percentage changes in aggregate variables relative to their baseline levels at $\delta_z = 0.1$. As δ_z increases, the model exhibits a standard quantity–quality trade-off: fertility declines while investments in children rise. What role does the comparison motive play? The presence of the externality significantly amplifies the responsiveness of both fertility and parental investment to SBTC, as clearly visualized by the steeper blue solid lines ($\chi = 0.1$) compared with the red dashed lines ($\chi = 0$). This highlights the role of comparison motives as an amplification mechanism, in line with Result 2.

We now examine how these dynamics are shaped by heterogeneous responses across types. Panels (b) and (c) of Figure 7 display the equilibrium responses to SBTC by type. In Panel (b), the low type without the comparison motive ($\chi = 0$) shows no behavioral change, while the high type in the bottom panels reduces fertility and increases per-child investment.[23] In contrast, when comparison motives are present, the low type (panel (b)) adjusts their behavior in the same direction as the high type (panel (c)), despite no change in their own income—illustrating spillover effects through equilibrium. As the benchmark level of child human capital rises, driven by the high type's increased investment, the low type responds by reducing fertility and increasing investment. The high type further reduces fertility and increases child investment, as comparison motives reinforce their incentives to maintain a lead in relative status. This illustrates how comparison motives propagate the effects of SBTC across the entire population, thereby amplifying the aggregate fertility decline.

Result 4. *The comparison motive generates spillovers across income groups: when the benchmark group experiences income growth, other groups may still reduce fertility and increase child investment, even without any change in their own income.*

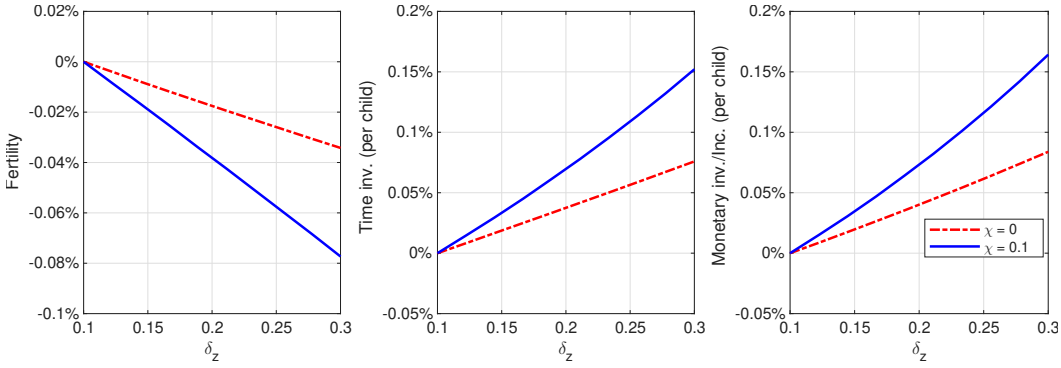
So far, our analysis focused on wage as the exogenous source of change. However, it is worth noting that the underlying mechanism may extend to other drivers. For example, in

22. The specific parameter values used for numerical results are reported in Table B1 in the Appendix. The comparative statics results presented here do not critically depend on the specific choice of parameter values, although they do influence the levels.

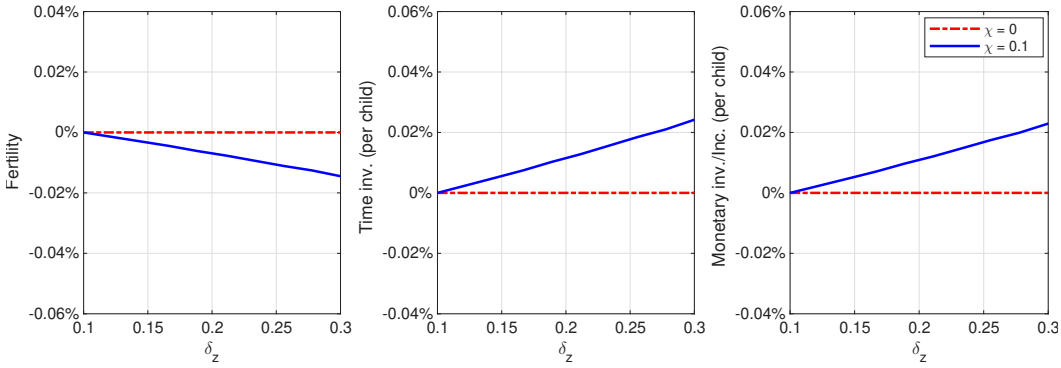
23. Note that fertility decreasing in δ_z does not mean that children are inferior goods. An increase in income unrelated to z, such as a transfer payment or lottery winnings, does increase fertility in our model.

Figure 7: Aggregate and Heterogeneous Effects of SBTC

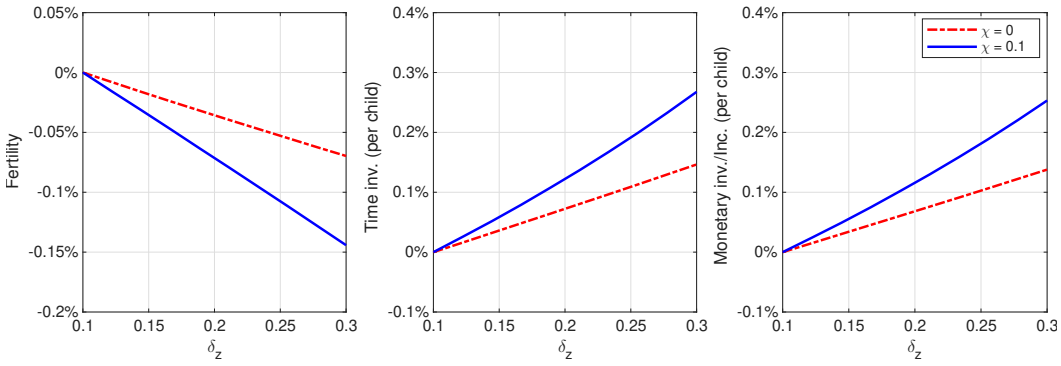
(a) Aggregate



(b) Low Type (z_l)



(c) High Type (z_h)



Note: All y-axis values are expressed as percentage changes relative to the baseline level at $\delta_z = 0.1$.

the U.S., the returns to education increased substantially in past decades, particularly during the 1980s and 1990s, and have remained high in recent decades (see, e.g., Doepke and Gaetani (2024)). This trend has heightened the importance of early childhood investment, particularly time investments among highly educated parents (Guryan and others 2008). Moreover, evidence suggests that parents increasingly perceive their own time as a critical input in shaping their children's development (List and others 2021). We also explore the implications of the rising importance of parental time inputs in our model, which naturally extends Result 2. See Appendix I.C for numerical results, summarized in Figure A4 and an extensive discussion of this point.

IV. Evidence on Comparison Motives and Fertility

We now provide and discuss some empirical evidence to argue that comparison motives help us understand fertility patterns observed in the data. We begin with a discussion of existing evidence on how private educational investments may spill over across families. Since this phenomenon and its potential connection to low fertility rates were first recognized in East Asia, the literature trying to establish causal relationships here focuses on these countries. However, we believe the mechanism from comparisons to low fertility is relevant in a larger set of rich countries beyond East Asia. Therefore, we next study cross-country data on fertility and its relationship with a series of proxies for the strength of the comparison motives. While providing convincing causal evidence is difficult, we document several empirical relationships that are in line with the model's predictions. Finally, we turn to the U.S. and provide suggestive evidence linking regional differences in upward comparisons, through social media connections, or the competitiveness of college entrance to low birth rates.

IV.A. Evidence on Private Education Investment Spillovers

A central testable implication of our theory presented in the previous section is that if one group of parents increases its education-related spending for their children, this causes other parents, who compare their children to the former, to also increase their own investment. It has been widely documented that private education investments outside of the schooling system, also called shadow education, are substantial and have been growing in many East Asian countries, a phenomenon sometimes referred to as "education fever". For example, the great majority of schoolchildren in Korea participate in private after-school education

programs. In fact, enrollment in *hagwons*—private, for-profit institutions offering after-school instruction in subjects such as English, math, and art—as well as individual or group tutoring, has reached around 80% in recent years, across all stages of schooling. These programs are typically costly for families, with average monthly education expenditures per child amounting to roughly 10% of family income.

It is difficult to rationalize such high participation rates and expenditures, based solely on conventional economic factors such as returns to education. Kim and others (2024) argue that the observed "education fever" is partly driven by education spending spillovers: parents seek to match or exceed the investments of others, reinforcing a broader cultural emphasis on education rooted in Confucian values. Estimating the causal effect of such spillovers, however, is challenging due to endogeneity.

To address this, Kim and others (2024) exploit recent changes in curfew laws in Korea that prohibited *hagwons* from operating beyond certain hours (e.g., 10 p.m. or midnight). Because late-night attendance is more common among wealthier families who can afford more programs that require higher spending, these curfews primarily affected rich households while having little direct impact on lower-income families. The provincial variation in curfew rules thus provides an instrumental variable for high-income households' education expenditures. Their estimates suggest that a 10 percent change in private education spending among the top 15 percent of households raises private education spending in the lower half of the income distribution by about 0.5 percentage points (relative to household expenditure), a sizable effect given that their average spending is around 6 percent.

Another piece of evidence on education investment spillovers comes from Rossi and Xiao (2023). The authors find that a reduction in fertility among Chinese women caused by the imposition of birth quotas in the 1970s also lead to lower fertility among women from ethnic minority groups who were exempt from the quotas. Underlying these spillovers are, next to a cultural conformism channel, economic reasons working through the quantity-quality trade-off. Parents directly affected by the quotas reduced the quantity of children but raised their quality, measured by educational attainment. At the same time, the education of children from ethnic groups who regularly compete with these—now more educated children—in the labor market, also increased. This suggests that, in line with our theory, comparison motives give rise to an education spending externality, depressing fertility.

IV.B. Comparison Motives and Fertility Across Countries

In order to test whether there is a negative relationship between comparison motives and fertility across countries, as predicted by our theory, we need to find suitable proxies for the strength of upward social comparisons. As discussed before, we believe that such comparisons can play a role in a variety of settings, with education being an important example. For that reason, we use as a first proxy the degree to which parents are worried about their child's education. Concretely, we measure this using the responses to the following question from the World Values Survey (WVS): "To what degree are you worried about the following situation—Not being able to give one's children a good education?" As a second proxy, we use a measure of intensive parenting styles across countries. More intensive parenting arguably comes with stronger comparison motives among parents. To construct this, we again use data from the WVS, and responses to a question about which values parents find important when raising a child. Following Doepke and Zilibotti (2019), a high share of parents indicating that "hard work" is important is indicative of intensive parenting styles in that country. Thirdly, countries with stronger comparison motives are more likely to emphasize extensive after-school private education. Measuring these shadow education activities across countries is not straightforward. To get an idea, we use data from the PISA 2012 student survey, where students were asked about the total number of hours in a week during which they received lessons in math, language, science, and other subjects outside of regular school hours.

We present the results of simple linear regressions, regressing fertility levels (in Panel A) and changes in log fertility rates over time (in Panel B) on these three proxies of comparison motives and country-specific controls in Table 1. More details on the construction of the proxies and the full list of covariates are reported in Appendix Tables B2 and B3. In all of our cross-country analysis, we restrict the sample to high-income countries, according to the World Bank classification of 2023, with a population of at least 5 million as of 2020.

Column 1 of Table 1 shows that high-income countries where parents report greater concern about providing a good education tend to have significantly lower fertility rates. This pattern is consistent with our Result 1. Similarly, the cross-country relationship between intensive parenting styles, measured by the share of parents valuing hard work when bringing up a child, and fertility levels is negative, as shown in Column 2. Notably, this negative relationship exists even after including country and year fixed effects, as shown in Appendix Table B2.[24] While shadow education, measured by out-of-school lessons, is not significantly

24. A fixed effects regression is possible here since the question about parenting values is asked repeatedly

related to fertility *levels*, see Column 3, the data shows a negative association with fertility *changes*. As shown in Column 6, high-income, high-population countries where students spend more time on shadow education activities experienced larger declines in fertility between 2012 and 2022.[25] This is in line with Result 2—that the comparison motive can *amplify* fertility decline. A similar pattern can be observed when looking at countries where parents reported on average larger education worries, which is associated with larger drops in fertility between 2010 and 2022 (Column 4), though it does not seem to hold when using intensive parenting (Column 5).

Table 1: Regression Results of Fertility on Proxies for Comparison Motives across Countries

	Panel A			Panel B		
Dependent Variable	Total Fertility Rate			Log TFR Change		
	(1)	(2)	(3)	(4)	(5)	(6)
Education worries	-0.341***			-0.205*		
	(0.0878)			(0.0817)		
Share praising hard work		-0.566**			0.157	
		(0.171)			(0.223)	
Total out-of-school lessons			-0.0294			-0.0458*
			(0.0365)			(0.0172)
Observations	32	93	32	20	29	32
R^2	0.315	0.113	0.120	0.450	0.167	0.484

Notes: Results of OLS regressions of total fertility rates (Panel A) and log differences of total fertility rates (Panel B) in high-income, high-population countries on different proxies of the strength of comparison motives. For all regression models in Panel A, we take all country-year observations where both TFR and the comparison motive proxy were available. For Column (3), this is always the year 2012. Column (4) reports results from a regression of the log change in TFR between 2022 and 2010 on the earliest education worry observation per country that was measured in the WVS. This data starts in 2010, which is why we look at the change in fertility between 2010 and 2022. Column (5) reports results from a regression of the fertility change between 2022 and 2000 (in logs) on the earliest parenting values observations for each country starting in 2000. Column (6) reports results from a regression of the log change in TFR between 2022 and 2012, the year of the PISA survey on total out-of-school lessons in each country. More details are given in Appendix Tables B2 and B3. All regressions include a constant and three country-level economic characteristics: GDP per capita, unemployment rate, and population. Data on these and fertility come from the World Development Indicators. Data on education worries and parenting values come from the WVS. Data on out-of-school lessons from the 2012 PISA Student Questionnaire. Stars indicate statistical significance levels: $^{*}(p < 0.05)$,** $(p < 0.01)$,*** $(p < 0.001)$.

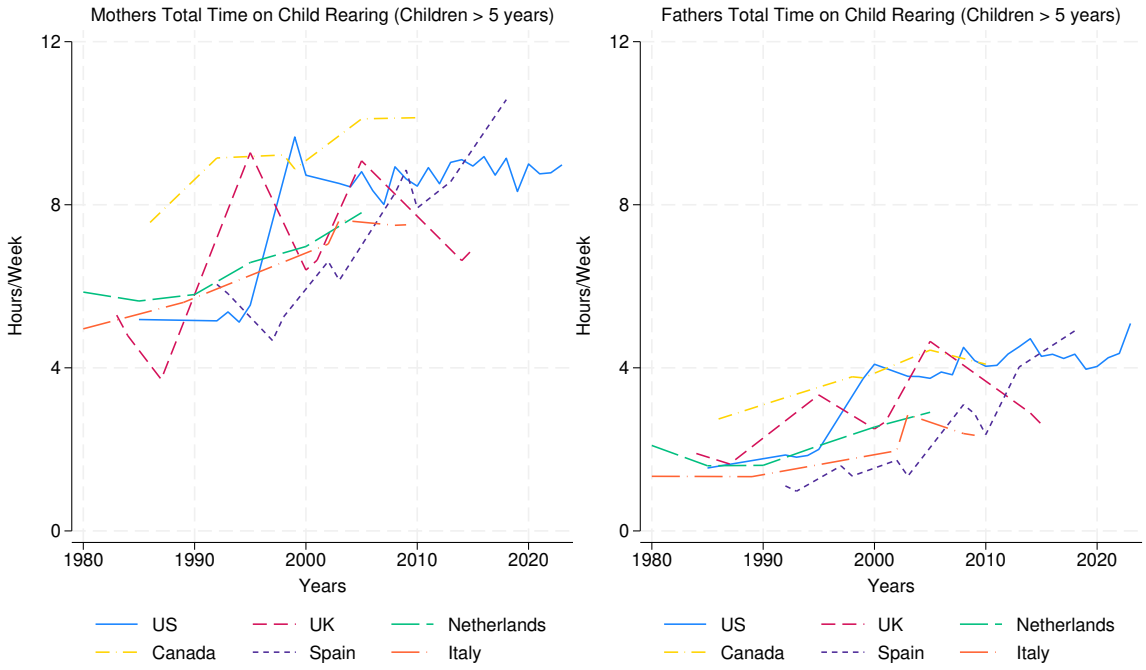
Taken together, these findings provide some macro-level evidence suggesting that coun-

in several countries.

25. The PISA student survey also includes a measure of study time spent with a commercial provider or private tutor. This measure is also negatively correlated with fertility changes, as shown in Appendix Table B3.

tries where comparison motives are arguably stronger often also experience lower fertility levels and larger drops in fertility over recent years. As explained through the lens of our simple model in Section III, the mechanism through which comparisons suppress fertility choices is because they induce higher parental investments (see Result 3). Reliable cross-country data on parental investments, in particular monetary investments, is scarce, which makes testing this mechanism against our empirical proxies of comparison motives difficult. However, data on parental time use from the Multinational Time Use Study (MTUS) suggest that the time both mothers and fathers spend rearing their school-aged children has indeed been rising across a set of high-income countries over the past decades, as we illustrate in Figure 8.

Figure 8: Total Child Rearing Time



Notes: The figure shows the average estimated total time parents in the age group 25-34 spent with their children aged 5 to 17 in six countries, separately by mothers (left) and fathers (right). Estimates are obtained using regressions following the specification in Doepke and Zilibotti (2019, Fig. 2.1), which is based on Ramey and Ramey (2010). Data come from the Multinational Time Use Study (MTUS).

IV.C. Upward Comparisons, College Competition and Fertility in the U.S.

We now turn to an empirical investigation of the relationship between social comparisons and fertility in the U.S. To this end, we first present cross-sectional patterns on different measures of comparison motives and fertility using regional variation that support the theoretical results we presented in Section III. We then explore whether the strength of the comparison motive might have increased over time, potentially contributing to the recent fall in fertility in the U.S.

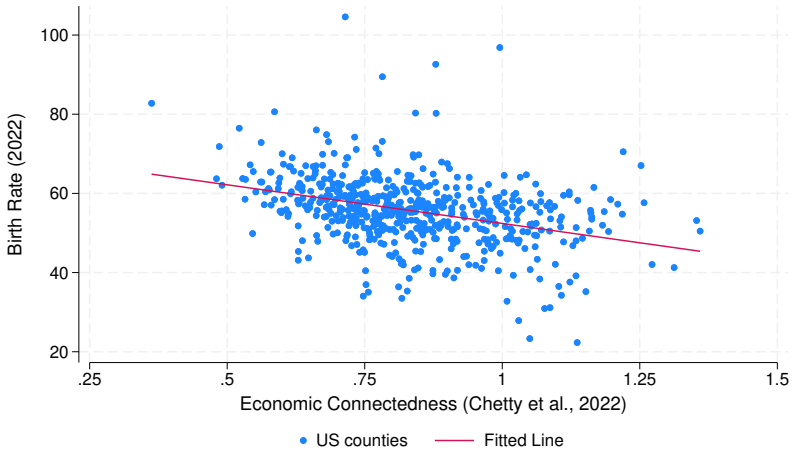
As a first, direct measure of the strength of social comparisons, we use the *economic connectedness index* proposed and measured by Chetty and others (2022), which is available at the county level in the U.S. It captures upward social ties across socioeconomic status (SES) through social media connections and thus serves as a suitable proxy for the intensity of comparison motives—particularly the upward comparisons modeled in Section III. As shown in Figure 9, U.S. counties with stronger upward comparison tendencies—reflected in higher economic connectedness (EC)—exhibit lower birth rates. Comparing, for example, a county at the 75th percentile of the EC index (0.94) with a county at the 25th percentile (0.70), the birth rate is almost 5 births per 1,000 women lower (53.6 compared to 58.4).[26]

More formally, we show in Table 2 that the negative relationship between comparisons and fertility persists after controlling for county characteristics. Column (1) suggests that a one standard deviation larger economic connectedness is associated with almost 4 births less, or around half a standard deviation of the birth rate in 2022. This pattern also holds when looking only at the networks of high-SES individuals (Column 2). Having a higher share of connections to high-SES persons—accompanied by arguably stronger comparison motives—is related to lower fertility. A negative link to fertility also exists for other measures of social capital and connections reported by Chetty and others (2022), such as civic engagement, measured by the density of civic organizations in a county (Column 3) and cohesiveness of networks, the extent to which two friends of a given person are also each other's friend (Column 4). Arguably, comparison motives are stronger in more cohesive societies. Taken together, these results thus provide suggestive evidence for Result 1.

Another important driver of social comparisons may be related to the competitiveness

26. To interpret the EC index, note that an EC of 1 means that low-SES people have an equal number of low-SES and high-SES friends, while 0.5 means that only a quarter of the connections of low SES-people are with high-SES people.

Figure 9: Upward Social Connections and Fertility across U.S. counties



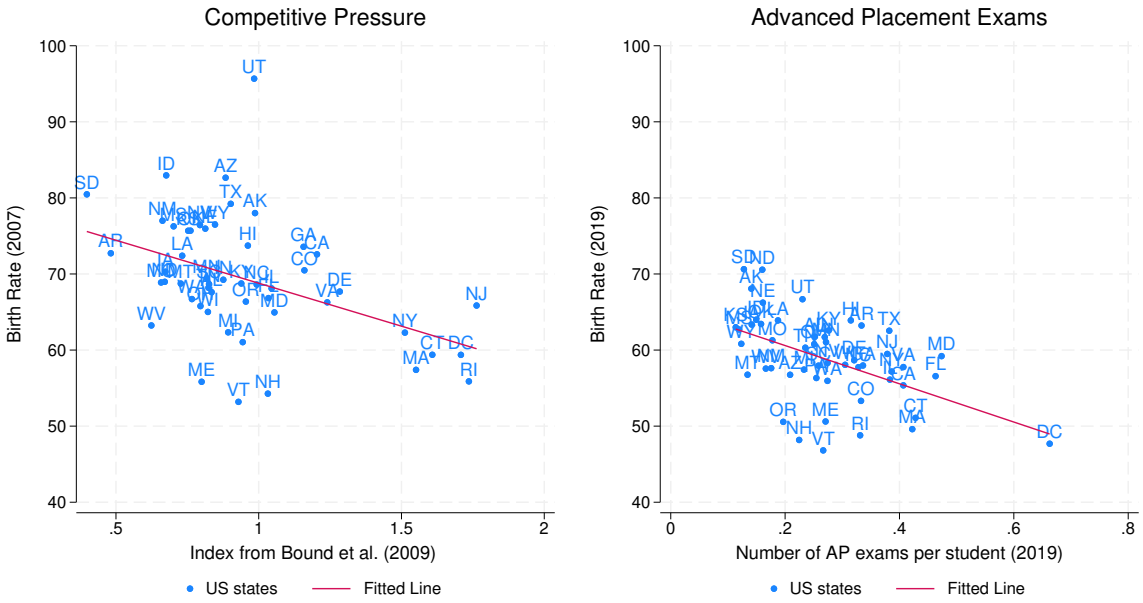
Notes: Upward social connections are measured through the economic connectedness index from Chetty and others (2022). It is calculated using Facebook user data as the share of above-median SES friends among users with below-median SES, divided by 50%, where SES is measured using information on individuals' ZIP codes, colleges, cell phone models, and other indicators of SES; see Chetty and others (2022) for details. Because the data are from 2022, we plot them against county-level birth rates in that year. These data come from the Center for Disease Control and Prevention, National Center for Health Statistics. They are calculated as the number of births per 1,000 women aged 15–44 years old in the given year. Only counties with a population of 100,000 persons or more are shown.

of the education system. More than a decade ago, Ramey and Ramey (2010) argued that rising competition for college admission was driving parents, especially those with a college education, to spend more time on child-rearing. They termed this phenomenon the *rug rat race*. Using U.S. cross-state data, they showed that time spent on child care was positively related to an index of college competitiveness.[27] Competitive pressure arising from college admissions may be an important reason behind what we termed comparison motives. If so, one would expect a negative relationship between college competitiveness and fertility. Using the same index, we indeed find that it is negatively associated with birth rates across U.S. states, as shown in the left panel of Figure 10.

Since the original competitiveness index is based on data from the early 1990s, we turn to one of its key components—the number of Advanced Placement (AP) exams taken per student—which is publicly available for more recent years and serves as a proxy for ongoing

27. This index, originally constructed by Bound and others (2009), captures the competitive pressure high school students face in gaining college admission. It is calculated as the sum of the fractions of students in each U.S. state (in 1992) who engaged in behaviors such as taking the PSAT, taking an AP exam, spending 10 or more hours on homework per week, using private test preparation services, and applying to five or more colleges.

Figure 10: Fertility and Competitive Pressure across U.S. States



Notes: Left Panel: Birth rates in U.S. states in 2007 plotted against the competitive pressure index from Bound and others (2009), taken from their Appendix Table 5. See Table B5 in the Appendix for more details on the construction of this index. Right Panel: Birth rates in U.S. states in 2019 plotted against the number of advanced placement exams per student. Data on AP exams come from the College Board Student data come from the National Center for Education Statistics. Birth rates by U.S. states come from the Centers for Disease Control and Prevention, National Center for Health Statistics. They are calculated as the number of births per 1,000 women aged 15–44 years old in the given year.

Table 2: Regression Results of Birth Rates on Social Capital in U.S. Counties

	Dependent Variable: Birth Rate in 2022 per U.S. County				
	(1)	(2)	(3)	(4)	(5)
Economic Connectedness	-3.831***				-1.925**
	(0.556)				(0.673)
Economic Connectedness (High SES)		-5.304***			-2.479**
		(0.713)			(0.884)
Civic Engagement			-9.766***		-9.097***
			(0.916)		(0.888)
Cohesiveness				-2.316*	1.376
				(0.906)	(0.846)
Observations	566	566	566	566	566
R^2	0.154	0.179	0.272	0.056	0.368
County-level controls	Yes	Yes	Yes	Yes	Yes

Notes: Results of OLS regressions of birth rates in U.S. counties in 2022 on standardized measures of social capital in that county, based on data and definitions from Chetty and others (2022). Details and variable descriptions are given in Table B4 in the Appendix and the notes to Figure 9. All regressions include a constant and three county-level economic characteristics in 2022: personal income per capita, total employment, and population. Stars indicate statistical significance levels: $^{*}(p < 0.05)$,** $(p < 0.01)$,*** $(p < 0.001)$.

competitive academic pressure. We find that this measure, too, is strongly negatively correlated with state-level birth rates in recent years, as shown in the right panel of Figure 10. The negative relationships remain robust after controlling for state-level economic characteristics, and they also hold when using average college acceptance rates as an alternative proxy (see Table B5 in the Appendix).

Fertility Decline in the U.S.

As shown in Section I, the U.S. has experienced a substantial fertility decline since 2007. In fact, the U.S. decline was one of the steepest within high-income countries, alongside several Asian countries (see Figure B1 in the Appendix). Could this decline be partly driven by the comparison motives?

It is quite likely that the type of upward social comparisons, which we proxied through the *economic connectedness index* in Figure 9, may have gained importance in recent years due to the rise of social media, which in turn was intensified by the widespread diffusion of mobile phones. Chae (2015) links media exposure to social comparisons about ideal

motherhood based on a survey in Korea. "Momfluencers" are a widespread phenomenon in many high-income countries today. Petersen (2023) documents and discusses the role of momfluencers in setting unattainable aspirations about being a mother in the U.S. Ouvrein (2024) conducts a study in the Netherlands and finds that regular exposure to romanticized images of motherhood by mommy influencers is associated with lower perceived parental self-efficacy.

In addition, comparison motives driven by the higher education system may have also intensified in recent decades due to increased competitiveness in the college admission process, reflected in how much students prepare to secure them. As shown in Figure 11, the fraction of high school students taking college entrance exams has steadily increased over the last two decades. At the same time, the number of private tutoring centers has also grown substantially. While the number of elite colleges and universities has remained roughly constant, increased test-taking and college preparedness suggest that perceived competition has intensified, potentially reinforcing comparison motives among parents and putting more downward pressure on fertility.[28]

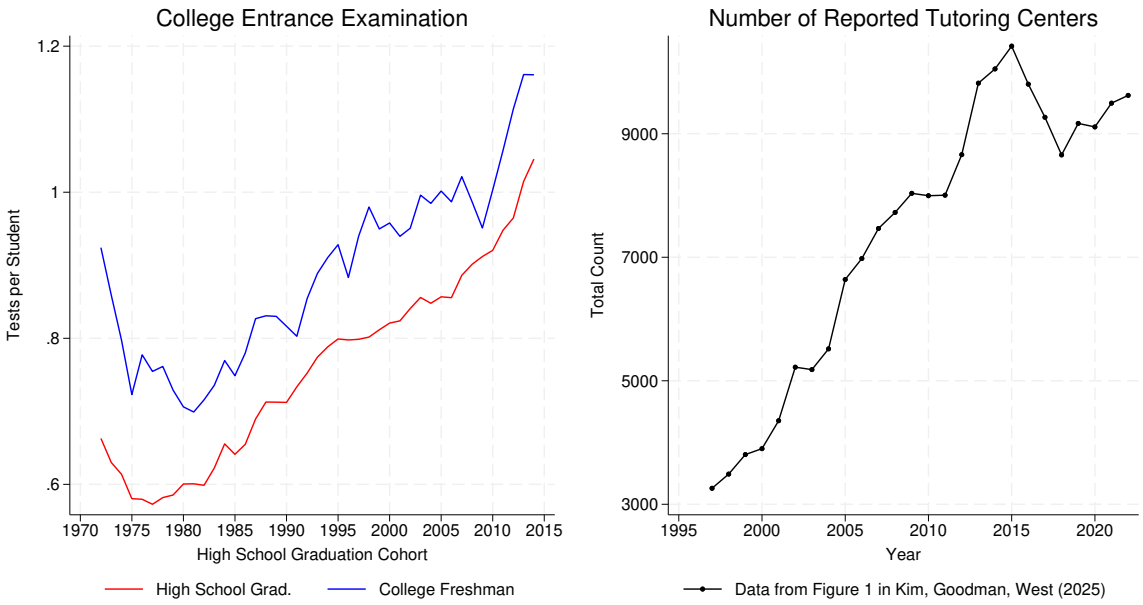
Table 3 presents supporting evidence in this direction from a regression of changes in birth rates on changes in college acceptance rates across U.S. states. The positive coefficient means that states that experienced larger increases in college competitiveness, proxied by declines in the average college acceptance rate, saw more pronounced declines in state-level birth rates. A graphical illustration of this relationship is shown in Figure B3.

Among the groups that saw the largest fertility declines in the U.S. in recent decades are Hispanic Americans (see e.g. Kearney and others (2022)). In this context, it is striking that college enrollment among Hispanic 18-to-24-year-olds rose from 15.8% in 1990 to nearly 40% by 2016, with the sharpest gains between 2008 and 2016—precisely the period that also saw the steepest fertility drop (see Figure 12). Comparison motives among Hispanics amplified by modern technology and social media may have played a role here. In addition, spillovers across racial and ethnic groups may have helped trigger these effects. For example, greater emphasis on educational attainment among White Americans may have raised aspirations among Hispanic and Black Americans. These patterns align with our Result 4, where upward comparisons generate cross-group spillovers that contribute to fertility decline.

Relatedly, one might wonder whether the so-called "rug rat race" is a phenomenon con-

28. See also Blandin and Herrington (2022) who document changes in test-taking and college preparedness for the U.S.

Figure 11: Tutoring Centers and College Admissions Tests in the U.S.



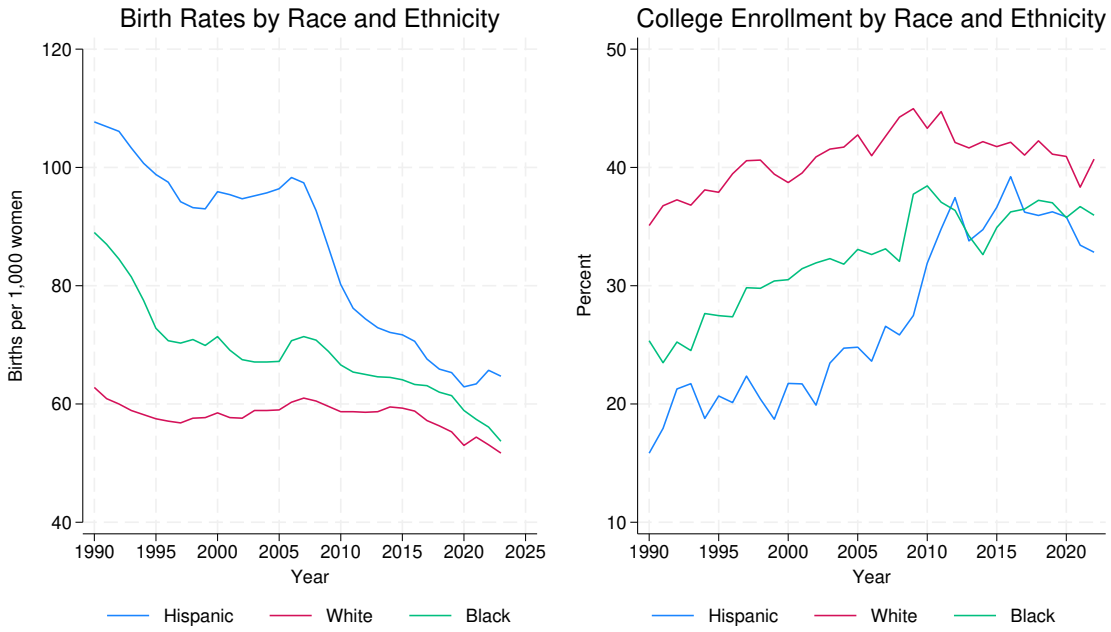
Notes: Left panel reports the sum of SAT and ACT tests taken per high school graduate and college freshman over time in the U.S. Data come from Hendricks and others (2021, Figure 7). The right panel reports the number of tutoring centers in the U.S., estimated by Kim and others (2025, Figure 1).

Table 3: Regression Results of Birth Rates on College Acceptance Rates in U.S. states

	Change in log Birth Rates (2007-2019)	
	(1)	(2)
Change in log College Acceptance Rates (2007-2019)	0.274**	0.334**
	(0.0869)	(0.123)
State-level controls	No	Yes
Observations	51	51
R^2	0.110	0.305

Notes: Results of OLS regressions of changes in the logarithm of birth rates between 2007 and 2019 on the log changes in average acceptance rates of 4-year colleges in U.S. states during the same time. Acceptance rates are based on data from National Center for Education Statistics. State-level controls in column (2) include local GDP, population, and employment in 2007 and 2019. These data come from from the Regional Economic Accounts from the U.S. Bureau of Economic Analysis. All regressions include a constant. Stars indicate statistical significance levels: $^{*}(p < 0.05)$,** $(p < 0.01)$,*** $(p < 0.001)$

Figure 12: Birth Rates and College Attendance by Race and Ethnicity



Notes: Left panel: Birth rates by race and ethnicity in the U.S. over time. Data comes from the CDC Natality Database. Right panel: Share of 18- to 24-year-olds enrolled in U.S. colleges, by race and ethnicity. Data from the Integrated Postsecondary Education Data System of the National Center for Education Statistics.

fined to high-SES families. Recent empirical evidence suggests that it may be a broader phenomenon. For instance, parental time with children has increased over time also among non-college educated parents in the U.S. and several other countries (Doepke and others 2023; Dotti Sani and Treas 2016). This is true both for fathers and mother separately. Further, Ishizuka (2019, 2025) shows that intensive parenting aspirations and practices have become widespread across social classes in the U.S., contributing to a new ideal of good parenthood. Lubiewska and others (2025) analyzes data from 11 countries and finds that intensive parenting is quite prevalent in lower social status families. In Korea, spending on after-school private education is now nearly universal and private education spending relative to income is highest in low-income families (Kim and others 2024). These findings are again broadly consistent with our Result 4 and suggest that comparison-driven parenting extend beyond elite families. In equilibrium, low-type parents adjust their behavior in response to educational benchmarks set by high-type parents. This endogenous spillover illustrates how comparison motives can drive an educational arms race across the income distribution.

V. Policy Implications Based on the Comparison Motive

This section explores what policy implications follow from the comparison motive. While much of the current debate seems to take the need for policy interventions to stimulate the birth rate for granted, we prefer to stick to the usual tools of welfare economics and analyze whether fertility is indeed below the social optimum and if so why. To this end, we start by solving for the socially optimal fertility rate in the model considered in Section III. We then present a model of college competition to show that educational investments can be socially wasteful. Finally, we discuss policy options to address the resulting inefficiencies.

V.A. Comparison Motives and Socially Optimal Allocations

In Section III, we analyzed the equilibrium choices made by individuals in a decentralized setting. How do these equilibrium outcomes differ from the socially optimal allocations in which the externality is fully internalized?[29] This provides a natural starting point for examining the potential role of policy interventions.

To build intuition, we begin with the social planner's problem in the simple, analytically tractable homogeneous-agent economy described in Section III.A. Specifically, the planner selects allocations to maximize identical individual utilities:

$$\max_{c,n,x>0} \; [\ln c + \omega_n \ln n + \omega_h \ln (h - \chi h)] \tag{14}$$

subject to:

$$c = (1 - \lambda n - xn)z \tag{15}$$

$$h = h_0 + x \tag{16}$$

$$\lambda n + xn \in [0, 1] \tag{17}$$

A key feature of the planner's problem is that, unlike individual agents, the planner does not take the benchmark human capital level as given; instead, the planner fully internalizes the

29. In our simple model, issues about the appropriate optimality definition do not arise because we do not explicitly model the children as agents with their own utility function. Thus, we can use the regular definition of Pareto Optimality. In an OLG version of the model questions about how the planner should weigh utilities of different generations, including those unborn, would naturally arise. For a more thorough treatment of this issue, we would like to refer the reader to the discussions in Doepke and others (2023, Section 7) and Kim and others (2024, Section 6).

effect of per-child investments x on the benchmark human capital level h.

The solution to the planner's problem yields the socially optimal allocations of parental investment (x^p) and fertility (n^p):

$$x^p = \frac{\lambda \omega_h}{\omega_n - \omega_h}, \tag{18}$$

$$n^p = \frac{\omega_n - \omega_h}{(1+\omega_n)\lambda}. \tag{19}$$

When compared to the individually optimal fertility and time investment choices in (6) and (7), it follows directly that:

$$x^* \geq x^p \quad \text{and} \quad n^* \leq n^p, \tag{20}$$

with equalities holding only when $\chi = 0$. This implies that in the presence of the comparison motive, equilibrium fertility is always below the socially optimal level, while education investments are excessive from a societal perspective.

Result 5. *In an economy with comparison motives, equilibrium fertility is inefficiently low, and parental education investments are inefficiently high.*

The inefficiency provides a justification for policy interventions, such as taxing private education investments or implementing pro-natal transfers. To make this concrete, we assume that the policymaker has two policy instruments available: a tax on parental time investments τ and a birth subsidy T, such that the right-hand side of the individual family budget constraint additionally includes: $-\tau x n + T n$. With the two instruments, the policymaker can implement the first-best investment (x^p) and fertility levels (n^p) in (18) and (19) by setting:

$$\tau = \frac{\chi}{1-\chi} \tag{21}$$

$$T = \frac{\lambda \chi \omega_h}{(1-\chi)(\omega_n - \omega_h)}, \tag{22}$$

as proven in Appendix Section I.D.

Result 6. *The first-best allocation can be implemented through a parental investment tax that finances pro-natal transfers.*

That is, a combination of a tax on parental investments with pro-natal transfers that both increase in the strength of the comparison motive χ, successfully aligns private and socially

optimal choices. Moreover, the government's budget is exactly balanced.[30] Although our simple analytic model focuses on parental time—which may be difficult to tax in practice—the same logic extends to taxing monetary investments, such as spending on private schools or after-school private education institutes (i.e., *hagwons*) in a general framework with complementary inputs of time and money or a framework where monetary investments are more relevant parental inputs such as in East Asia (Kim and others 2024).

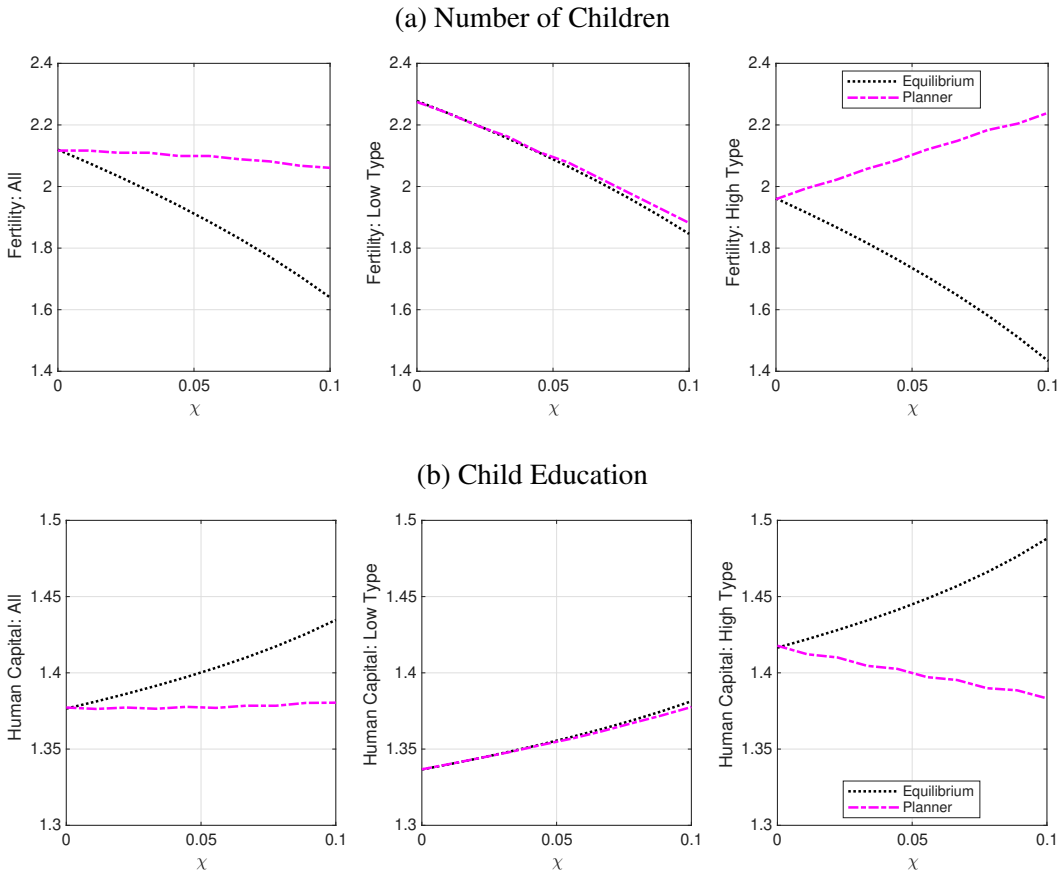
To explore optimal allocations across types beyond the aggregate implications, under a more realistic setting with heterogeneity and upward comparison motives, we return to the heterogeneous-agent model in Section III.B. The planning problem is fully described in Appendix I.E. Having heterogeneity in a welfare analysis adds complexity, as the planner's solution depends on the choice of Pareto weights φ_i. In principle, one could trace out the full Pareto frontier by varying these weights. However, to isolate the distortions arising specifically from the externality—abstracting from redistributional concerns—we follow Kim and others (2024) and adopt a version of Negishi weights, setting $\varphi_i = z_i$. This approach ensures that, in the absence of the comparison motive ($\chi = 0$), the planner's allocation coincides with the decentralized equilibrium.

We consider different strengths of the comparison motive $\chi \in [0, 0.1]$, and compare the decentralized equilibrium outcomes to the efficient allocations in Figure 13. The first panel shows that a stronger comparison motive (χ) leads to a substantially lower equilibrium aggregate fertility, whereas the socially optimal fertility remains relatively stable. The next two panels decompose this result by type. While the planner consistently chooses higher fertility than the equilibrium for both types, a notable pattern emerges for the high type: as χ increases, the planner assigns them even higher fertility than in the case without comparison motives. This elevated fertility among high types largely offsets the decline among low types in the planner's solution, resulting in a relatively flat optimal aggregate fertility rate.

Stronger comparison motives substantially increase equilibrium parental investments, particularly among high-type parents. In contrast, the planner reduces high-type investment as χ rises. This reflects that, in the planner's objective, the educational advantage of high-type children imposes a negative externality on others. The bottom panels of Figure 13 illustrate that, as a consequence, the planner curbs the extent of educational advancement among high-type children, mitigating an inefficient and socially costly arms race in education. Summarizing these insights gives Result 7.

30. Note that $\tau x n = Tn = \left(\frac{\chi}{1-\chi}\right) \frac{\omega_h}{(1+\omega_n)}$.

Figure 13: Quantity and Quality of Children in Equilibrium and Social Planner's Solutions



Result 7. *In an economy with two productivity types, upward comparison motives induce excessive parental investment and reduce fertility, lowering aggregate welfare for both groups. The gap between equilibrium and optimal fertility, as well as the gap in parental investments, is larger for the high type.*

What additional policy insights emerge from this model? With upward comparison motives, high-income parents impose an externality on others. Thus, to bring the economy closer to the planning solution, parental investment taxes and pro-natal transfers should be focused on high-type parents.

V.B. College Admissions and Wasteful Education Spending

In the model, parental investment taxes lower education investments, leading to lower child human capital. This is still welfare-improving because of parents' comparison motives.

However, the utility of children themselves does not appear explicitly in the model. From the children's perspective, one could thus still argue that they may be worse off in a world with such taxes, which could indeed reduce their human capital. If so, then the welfare and policy conclusions become less clear.[31]

At the same time, note that what matters for our theory is what parents perceive as valuable in raising child quality, which may not necessarily translate into actual improvements in children's human capital. Examples may perhaps include elaborate hand-made school lunches or driving kids to school even though a school bus is available. On top of that, some investments may be completely wasteful or even harmful. We view wasteful spending as most evident in the context of preparation for college admission. As we argued earlier, the college admissions system may be a deeper structural driver of comparison motives. Competition for college admissions frequently involves ranking children relative to one another, making it a common situation where parents feel the need to "keep up."

One could imagine that much of parental education spending is directed toward increasing the probability of college admission, yet contributes little to a child's human capital if admission is not secured. For example, Gu and Zhang (2025) and Kang (2024) develop quantitative lifecycle models featuring related college competition mechanisms in the context of China and Korea, respectively. Here, we use a very simplified framework to illustrate the idea of an inefficient educational arms race, driven by wasteful educational spending.[32] To keep things simple, we will not model fertility choice explicitly here, but discuss the implications for fertility at the end.

Suppose there is a continuum of parents, each with one child of different ability, $a \in [0, 1]$. For simplicity, assume all parents have income I. A child's future wage is determined by productivity: without college, productivity equals ability, so $w = a$; with college, productivity (and thus wages) increases to $w = (1 + A)a$. Suppose there is a fixed measure of college slots, b. Admission officers seek to admit the best students (those with the highest value-added in college) but cannot observe ability, a, nor the effort spent on application preparation, p. Instead, they observe only the entire application package as a signal of true

31. To fully address these issues, one would need a fully dynamic model where children appear as agents with their own utility function and the possibility of becoming parents themselves. If children also had comparison motives about their own status relative to their peers, they would also face the externality and hence be willing to compromise some human capital if that meant their peers would do the same.

32. Kim and others (2024) also present a college competition model with limited college capacity. Ramey and Ramey (2010) consider a model where the scarcity of (elite) college slots raises parental time investments, particularly among more educated parents. In their framework, however, such investments are not wasteful as they do increase human capital.

ability: $s = a + p$.

Parents derive utility from their child's future earnings. They choose investments in application preparation, recognizing that greater preparation increases their child's probability of admission. Importantly, these investments do not raise human capital per se; they only improve admission chances. Examples could include SAT prep courses or professional assistance with application essays. The child's future wages are a function of college attendance (which is a function of the ability signal).

Result 8. *Parents with children of ability $a \geq 1-b$ will invest in college preparedness $p > 0$ and their children will go to college and earn wages $w = (1 + A)a$, while parents with children of ability $a < 1 - b$ will set $p = 0$. Their children will not go to college and earn wages $w = a$.*

In the equilibrium of this simple model, all parents above the cut-off type, $1-b$, will spend money on preparing their children for college even though the investments are wasteful from a social point of view.[33] They do not create additional human capital that is productive down the road. The implications for fertility are straightforward. The college admission system makes children costly and hence parents will be hesitant to having many children.

In the model, welfare can be improved by banning college preparation activities. If $p = 0$ could be enforced, then the resulting equilibrium would feature the exact same children going to college, each learning the same amount as before, but at a lower cost to the parents and society at large. In particular, even the children in this model would prefer a world where college access was easier. This point is important, since, as argued above, even if there is over-investment in education from the parents' point of view, most children would typically not voluntarily give up their human capital in exchange for more siblings.

Wasteful spending may have increased in reality in recent decades, particularly in East Asian countries. A substantial portion of parental investment—particularly expenditures on test preparation (e.g., *hagwons*) and private tutoring—may be wasteful, as they focus on test-taking skills with limited value beyond the exams, contributing little to actual human capital formation. In fact, some of it may even be harmful to children. Intensive parenting practices, especially excessive after-school education, have been shown to negatively affect the mental health of teenagers (Kim and others 2022) and even younger children (Joung and Morgan 2024). These concerns are especially pronounced in China, Korea, Singapore, and Taiwan,

33. See Appendix I.F for a proof. Assuming that A is large enough, specifically, $(1 + A) > \frac{a}{a-b}$, ensures that even parents of high ability children invest a strictly positive amount.

where educational competition is particularly intense. Yet, the concern for the mental health of children has also grown in other countries in recent decades, particularly in the U.S. and parts of Europe (Agency for Healthcare Research and Quality 2022; Newlove-Delgado and others 2023). Intensive parenting practices have even raised concerns about parents' mental health, as evidenced by the recent warning of the U.S. Surgeon General.[34] For the children, the flip side of excessive study time is reduced time outdoors, less physical activity, and often insufficient sleep—all of which are important for healthy development. Excessive studying may have thus contributed to rising obesity rates and even to the increase in myopia.[35]

V.C. Policy Implications

What could a policymaker do? Result 6 shows that, in the context of our model, a combination of a tax on parental investments and pro-natal transfers raises fertility and welfare.[36] With upward comparison motives, such taxes should be focused on the upper end of the income distribution (see Result 7), perhaps through progressive taxes on certain private education expenses. Similarly, in the simple model of college admissions considered in the previous section, a welfare-improving policy would be to ban wasteful investments in college preparation. In reality, however, enforcement will be difficult. In the model, the assumption was that the college admission officer cannot distinguish between p and a and makes admission decisions based on s only. So, how could a government see and effectively ban such investments? More generally, parental inputs that come in the form of time investment cannot be easily taxed or regulated. While we acknowledge that policy intervention in this context is challenging, certain measures may point in the right direction.

First, certain forms of private education investments could, in principle, be taxed, regulated or even banned by the government. For example, 529 plans—tax-advantaged savings vehicles for higher education expenses in the U.S.—have been discussed in terms of their preferential tax treatment. During President Obama's administration, there was debate about

34. The U.S. Surgeon General, "Parents Under Pressure," U.S. Public Health Service, 2024.

35. Childhood myopia has increased substantially worldwide during the last three decades, especially so in urban areas and specifically in East Asia, and the duration of education has been suggested as a contributing factor (Liang and others 2025). Obesity has been linked to excessive homework in a sample of Chinese primary school students (Ren and others 2017).

36. Of course, other externalities such as knowledge externalities in the spirit of Lucas (1988) may lead to underinvestment in human capital, which would be a reason to subsidize education. As argued above, while different types of educational investments likely exist, not all of them truly increase human capital. Analyzing the interaction in a model with both types of externalities present and two types of educational investments would be an interesting avenue for future work.

potential reforms, primarily motivated by concerns about inequality, though no changes were implemented. Our research highlights a related, though distinct, rationale for reconsidering such structures. The recent *One Big Beautiful Bill Act*, passed by both the U.S. House and Senate this summer, expands 529 plans by increasing withdrawal limits and broadening the definition of qualified expenses, now including tutoring outside the home and fees for nationally standardized tests. From the perspective of our findings, this expansion may further reinforce comparison-driven educational spending, which could have implications for fertility decisions.

In fact, several other countries have recently implemented policies to tax or even ban certain private education expenses. For example, the U.K. abandoned the VAT tax exemption on private schools in 2025. China implemented the so-called "Double Reduction Policy" in 2021 (Qian and others 2024). A major element of this policy involved the curtailing of private after-school tutoring by essentially banning for-profit private tutoring providers. Similarly, the Korean government has, in the past, implemented curfews on *hagwons* and even a complete ban on private tutoring (Kim and others 2024). Of course, when private education institutions are banned, informal alternatives may emerge, which only high-income families could afford. This could lead to even more expensive underground markets and create unintended adverse effects of exacerbating educational inequality (Liu and others 2025). Taxing them, or eliminating tax exemptions, seems easier to enforce.

Another way of discouraging private investments might be to expand and improve public education. Since public education requires little time and money from parents, an improved public education system may also indirectly increase fertility. In fact, high parental investments might in part be a response to a—perceived or real—low quality public education system. Historically, when compulsory schooling was introduced in the U.S., the reliance on mothers' human capital weakened leading to greater social mobility (Althoff and others 2025). Applied to the modern context, instead of discouraging private investments, one could instead expand and improve public education.

A second set of policies could aim to directly weaken comparison motives or people's ability to act on such motives.[37] For example, governments could try to reduce the importance of centralized high-stakes exams. According to the OECD, at least one national or central examination was mandatory for all upper secondary students in around two-thirds of

37. If comparison motives are an intrinsic feature of preferences it may seem strange to want to influence them through policy. Yet, given they impose an externality, it would be welfare improving to weaken people's ability to act on such motives. Alternatively, one may also interpret the comparison motives as a reduced form way to capture competition introduced by the scarcity of high quality college slots.

the surveyed countries in 2023 (OECD 2023). In most countries, these exams are used not only for general admission to tertiary education, but also to select students for specific degree programs and for entry into competitive or selective higher education institutions (see Figure D6.4 in OECD (2023)). Because exam results are often publicly visible to students and parents through rankings (see Figure D6.6 in OECD (2023)), they likely contribute directly to comparison-driven behavior. Evidence also shows that students' mental health deteriorates particularly in the lead-up to high-stakes examinations (Chen and others 2024). Reducing the importance of such tests or limiting the visibility of student rankings would likely reduce parents' ability to act on the comparison motive, thereby mitigating excessive education investment and increasing fertility. Of course, high-stakes testing also serves an allocative role, and these benefits should be weighed against the costs in the form of lower student mental health and lower fertility.

Another way to soften the rat race to get into the best colleges would be to expand the number of slots in high quality colleges.[38] In particular, governments could consider increasing admission numbers in elite public universities. If increasing the number of slots is not feasible, the admission system itself could perhaps be reformed by adding some randomness to the selection process.

Several countries have recently considered policies in these directions. Since 2007, South Korea has introduced a nine-tier grading system for the national college entrance exam, replacing exact scores. Beginning in 2025, high schools will also shift from a nine-tier relative grading system to a five-tier absolute scale for internal assessments used in college admissions, with the aim of easing competition by reducing the weight of relative rankings.[39] China's "Double Reduction Policy" also includes a ban of student rankings among primary and junior high schools. Many U.S. universities made college admission tests (SAT or ACT) optional in the wake of the COVID-19 pandemic. It remains to be seen whether such changes can alleviate some of the competitive pressure families are facing and whether they have allocative effects.[40]

38. Of course the low birth rates could also act in a self-correcting way down the road, as smaller cohorts weaken the competition for college slots.

39. Germany has also moved to broad categories when it recently reformed its school sports competition for elementary and middle school children. The "Bundesjugendspiele" have been an annual track and field competition for all pupils up to 10th grade in Germany since 1951. A reform in 2023/2024 changed the system from a nationwide comparison to a within-school competition. Moreover, it was recommended to measure results not in precise units but broad categories. While the German example has nothing to do with college competition, the arguments given preceding the reform were also related to reducing competition among pupils.

40. In fact, Sacerdote and others (2025) find that test-optional policies reduced the probability that applicants from disadvantaged backgrounds are admitted to Dartmouth. Moreover some of the investments that high

Related to this, one could also ask whether international assessments of countries' education systems and achievements, for example through tests like the Programme for International Student Assessment (PISA), Trends in International Mathematics and Science Study (TIMSS), or the Times Higher Education Ranking (THE) have contributed to excessive parental investments. Having precise rank information, clearly facilitates parent's ability to act on their comparison motives. State and local governments have increasingly adopted practices to measure and publicly report the quality of local services, including schools and kindergardens. McArthur and Reeves (2022) find that the increased provision of information about school performance in the U.K. during the 1990s contributed to residential segregation, since parents reacted to the published metrics. It is thus conceivable that such information increases parental investments based on comparison motives. Therefore, governments should exercise greater caution when publishing precise rank information. For instance, introducing reporting results only in broad categories may help mitigate potential adverse effects.

Finally, governments could also seek to directly reduce comparison motives through non-educational channels, for example, by shaping policies related to social media. The negative effect of social media on children and teenagers has received much attention in recent years. For example, in May 2025, the EU Commission published draft guidelines on "protection of minors online under the Digital Services Act" which include a host of measures to protect children from online harm. However, its role in amplifying parental comparison behavior, which can drive overinvestment and lower fertility, and the potential impact of such regulations on parental behavior remain largely unexplored.

VI. Concluding Remarks

In this paper, we suggested comparison motives as a novel explanation for low fertility rates. Parents who compare their offspring's education against that of other children tend to overinvest into their children, raising the cost of children. Expensive children, in turn, lower desired fertility. We explored this idea in theoretical models and showed that stronger comparison motives lead to lower fertility. We further demonstrated that fertility declines driven by other forces, such as increased emphasis on child quality or skill-biased technological

school students take to get into a good college are quite useful to society, such as volunteering. Thus, reducing incentives for parental investments by allocating college slots randomly (or with some noise) will have clear side effects even beyond the allocative distortion.

change, are amplified by the comparison motive. We found that comparison motives generate spillovers across groups. We also offered empirical evidence for the connections between comparison motives and fertility. First, we documented spillovers in education expenses in South Korea. Second, we showed that proxies for comparison motives are negatively related to fertility rates in cross-country data. Third, we showed that proxies for comparison motives and measures of college competitiveness are negatively related to birth rates across US states and counties. We speculated that the growing salience of comparison motives—facilitated by the rise of social media—has contributed to declining birth rates over time.

Low fertility caused by comparison motives points to novel policy avenues. If fertility is low because of excessive private investments in children, then simple pro-natal transfers may not be the most effective policy. Instead, policy efforts should target the structure of the education system. We believe a broader discussion on how to discourage certain forms of excessive, and sometimes even harmful, private investments is needed. For example, private education institutions should perhaps not be tax-exempt—as is currently the case in many countries. The benefits of high-stakes testing as an entry pass to higher education should be weighed against its costs, including not only the adverse effects on children's mental health but also the potential to reduce fertility. Schools and local governments should also be more careful with publishing precise rank information, both about a child's performance but also about school quality. Economists often view more information as beneficial, leading to more informed and thus better individual choices and greater competition among schools and colleges, which can enhance education quality. However, when (local) capacity is limited, such precise information facilitates comparisons and thus can have negative implications for fertility.

Further, governments and medical societies may also sometimes directly affect the comparison benchmark through guidelines and official recommendations. For example, both the American Academy of Pediatrics and the Center for Disease Control provide parenting advice. While there is nothing wrong with the advice itself, it likely sets a benchmark for good parenting and following all of it can be quite time-consuming. Parents who wish to avoid being seen as neglecting official recommendations may opt for fewer children if they feel unable to meet the standard otherwise. Some such standards have even been written into law, such as car seat requirements or rules mandating permanent adult supervision even for older children. While car seats certainly improve safety, they also increase the cost of adding a third child, as most regular cars cannot accommodate three car seats. Finally, the impact social media has on comparison motives should perhaps be taken into account when

regulating social platforms.

There are several promising avenues for future work. While we have compiled a host of suggestive evidence for the link between comparison motives and fertility, clearer causal evidence would be desirable. One fruitful avenue might be to use the geographical roll-out of high-speed internet as an identification strategy. It would also be desirable to try to quantify the contribution of the comparison motive to cross-country fertility differences and to fertility declines over time. Given the friction introduced by the comparison motive, we have argued that novel policy strategies are needed. In reality, however, multiple frictions are likely to operate simultaneously. An interesting direction for future work would be to investigate and quantify optimal policies in a model with endogenous fertility that jointly incorporates several salient externalities such as comparison motives, environmental externalities and knowledge spillovers.

Beyond these, there may also be other externalities relevant for fertility decisions. For example, Ciliberto and others (2016) show that peer effects in the workplace can increase fertility (through social channels) but also depress fertility (through career concerns). There might also be comparisons simply about the number of children. In fact, Spolaore and Wacziarg (2021) document the historical diffusion of fertility and link it to (endogenous) social norms about limiting fertility. Externalities in leisure might be another relevant channel. While most models assume people do enjoy all non-work time as leisure, in reality, leisure is often a social activity spent with friends. Whether one's circle of friends has many children or not shapes the type of leisure activities of the group and thereby can change one's own desire for children. For example, if leisure activities mostly entail cocktail parties and theater visits, then children won't fit in easily and hence are costly. If one's social circle has many children and activities comprise family softball games and backyard BBQs, having a(n additional) child has only a limited impact on leisure activities. Another externality might be through local public goods. Children and families benefit from local public goods such as public libraries, parks, playgrounds, pools, and wide sidewalks. If a neighborhood comprises largely adults, the focus may instead be on wide roads and cocktail bars. As societies age, the shift from child-friendly public goods to senior citizen-related public goods may become more pronounced, leading to a vicious circle. These and other externalities deserve more attention.

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ONLINE APPENDIX

A. Theory Appendix

I.A. Solow Model with Retirement

Consider a simple Solow model. Let L be the labor force (=population), Y be aggregate output, K be aggregate capital stock, δ depreciation and n the population growth rate. Expressing everything in per capita terms, and assuming a CD production function, we have output per capita

$$y = Ak^{1-\alpha}$$

and the law of motion of the capital stock

$$\Delta k = i - \delta k - nk$$

In the steady state $\Delta k = 0$ so that

$$k^* = \left(\frac{sA}{\delta + n}\right)^{1/\alpha}$$

Since $y^* = f(k^*)$, it follows immediately that higher population growth (n) lowers GDP per capita.

So why are people now saying the opposite? They are worried that falling population growth depresses standards of living.

One factor that is missing from the simple Solow model is retirement. Let's now make a distinction between the number of people, N, and the number of workers, L. Let's ignore the fact that children do not work and focus on retirement as the idle period (could add childhood of course, but similar logic will go through). Assume people spend r fraction of their lives in retirement, which means that at any point in time fraction r people are retired so that $L = (1-r)N$. In terms of production, everything is as before, except that we are now interested in GDP per capita (y^N) which is no longer the same as GDP per worker (y^W). Output per worker is

$$y^N = \frac{Y}{N} = \frac{y^w L}{N} = \frac{f(k^w)(1-r)N}{N} = (1-r)f(k^w).$$

Using the functional form for $f()$ and plugging in the steady state capital stock, this can be written as

$$y^N = (1-r)A(\frac{sA}{\delta+n})^{(1-\alpha)/\alpha}.$$

When fertility rates fall, population growth slows, i.e. n falls, but it also affects the fraction of the population that is retired. These two factors move in opposite directions, and hence falling fertility may well depress GDP per capita, if the latter effect dominates the former. To make this point more clearly, let's connect r and n. Suppose people live for two periods, but work only when young. At any point t, we have P_t^y young people, P_t^o old people, and a total population of $P_t = P_t^y + P_t^o$. The fraction of the population that is retired is $r = \frac{P_t^o}{P_t}$. Further assume each person has n children. Then $P_t^y = nP_t^o$. We can now use these two equations to connect n with r.

$$r = \frac{P_t^o}{P_t} = \frac{P_t^o}{P_t^y + P_t^o} = \frac{1}{1+n}.$$

Or, equivalently $1 + n = 1/r$. Plugging this into the equation for GDP per capita, we have

$$y^N = \frac{n}{1+n}A(\frac{sA}{\delta+n})^{(1-\alpha)/\alpha}.$$

Clearly there are two effects that n has on y^N: capital per worker decreases which is bad, but workers per population increases, which is good. So when fertility falls and populations shrink the opposite happens: each worker has a larger capital stock which is good, but there are fewer and fewer workers per capita, which is bad. Likely the latter effect dominates and hence GDP per capita falls.

I.B. Inequality and Fertility

A defining feature of the economic landscape in recent decades across many developed countries has been the steady rise in inequality. For instance, as documented by Heathcote and others (2023), wage, earnings, and consumption dispersion among U.S. households has increased persistently over the past several decades. As a result, today's parents make fertility and investment decisions in a substantially more unequal environment, which—as noted by De La Croix and Doepke (2003), alters the context of these decisions across the income distribution. This could be even more consequential when parents evaluate their children's outcomes relative to others. In such settings, the comparison motive may amplify the rele-

vance of income gaps, increasing the perceived cost of falling behind.

We use our model to study how growing wage dispersion shapes fertility and child investment choices in equilibrium. Specifically, we model a mean-preserving spread in wages parameterized by δ_z:

$$\begin{aligned} z_l &= \bar{z} - \delta_z \\ z_h &= \bar{z} + \delta_z, \end{aligned}$$

which increases inequality while holding average income fixed at $\bar{z}$. We vary $\delta_z \in [0.1, 0.3]$, keeping all other parameters constant. To isolate the role of comparison motives, we again compare outcomes in the model without the comparison motive ($\chi = 0$) and with it ($\chi = 0.1$).

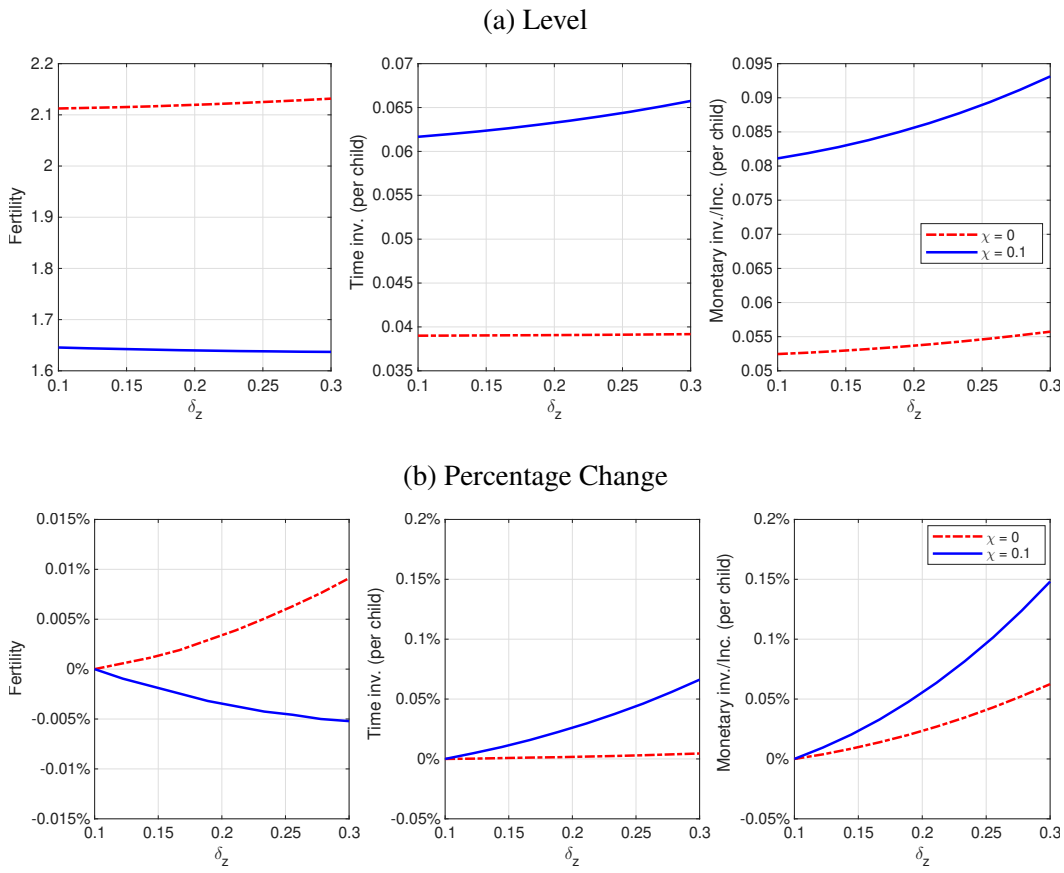
Figure A1 shows that in the absence of the comparison motive, rising inequality modestly *increases* both fertility and parental investments in aggregate. As illustrated in Figure A2, this pattern masks divergent responses across types: higher income among high-type parents leads to greater investment and lower fertility (bottom panels), while low-type parents, who become poorer, reduce investment but increase fertility (top panels).[41] These opposing movements largely offset each other, resulting in muted aggregate effects.[42] Empirically, the relationship between inequality and fertility is also by and large flat, as shown in Figure A3.

We now turn to the role of the comparison motive. As in the SBTC case, higher income among high-type parents increases their investments, thereby raising the benchmark human capital level $\tilde{h}$. This intensifies the pressure on low-type parents to increase their own investments, despite their declining incomes. As a result, the fertility decline among low types becomes more pronounced than would be implied by income effects alone. In the aggregate, when $\chi > 0$, rising inequality leads to stronger increases in parental investment and a reversal in the fertility response—from a modest increase to a slight decline—as shown in Figure A1.

41. This widening of fertility gaps across income groups is consistent with the findings of De La Croix and Doepke (2003).

42. For instance, compared to the SBTC exercise in Section III.B, which shares the same parameterization, the aggregate responses here are considerably smaller in magnitude.

Figure A1: Aggregate Effects of Inequality



Note: All y-axis values in the bottom panels are expressed as percentage changes relative to the baseline level at $\delta_z = 0.1$.

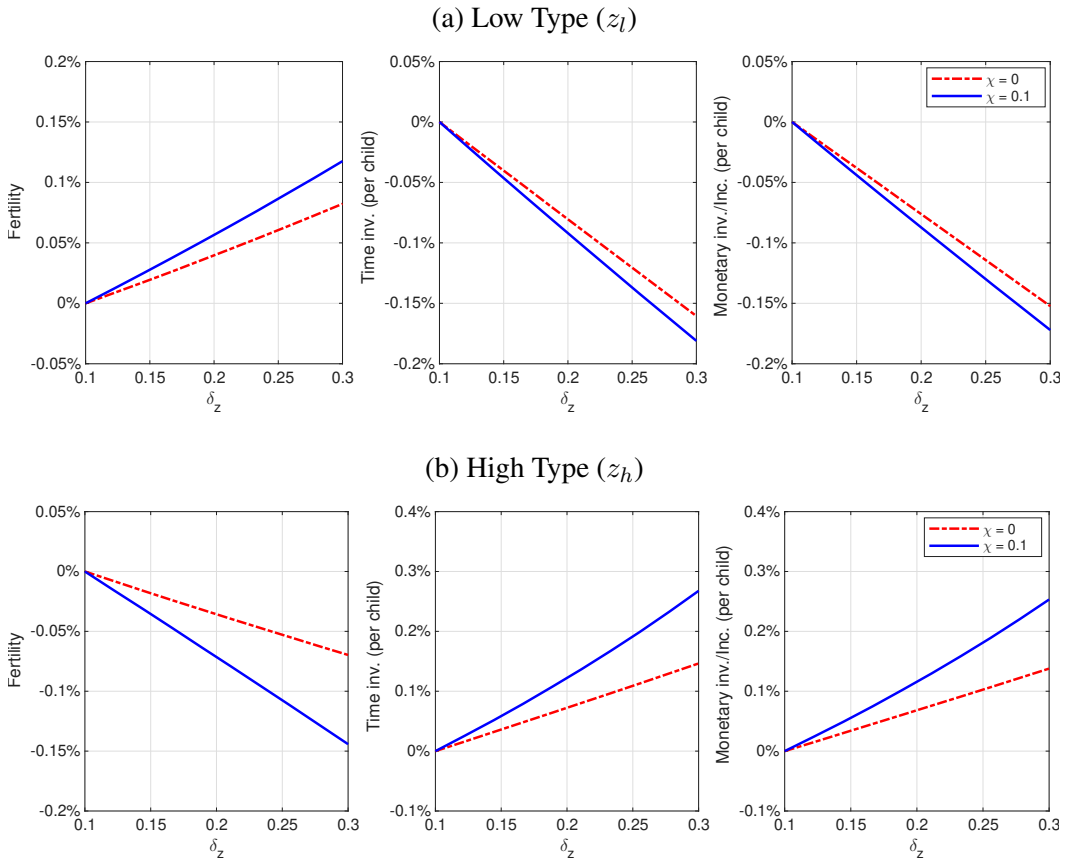
I.C. Rising Returns to Education and Parental Time Investment

We examine how a rise in the productivity of parental time inputs—modeled as an increase in $\alpha_1 \in [0.14, 0.17]$—affects fertility and investment outcomes within our model framework. To assess how social comparisons interact with evolving beliefs (or actual changes) about the importance of parental time, we again consider two scenarios: one without and one with upward comparison motives.

Result 9. *Higher returns to parental time investment lead to increases in time and monetary investments for both type of parents and declines in fertility. These effects are larger in an economy with stronger comparison motives.*

Figure A4 summarizes the aggregate effects. A higher emphasis on parental time leads to

Figure A2: Heterogeneous Effects of Inequality



Note: All y-axis values are expressed as percentage changes relative to the corresponding type's baseline level at $\delta_z = 0.1$.

increased aggregate investments, both in time and money as they are complementary, while reducing fertility. This occurs because the rising productivity of time inputs raises the opportunity cost of having additional children. Notably, the effects are highly nonlinear, especially in the presence of the comparison motive. When parents care about relative educational outcomes, the increased value of time intensifies the spillover effects, as parental investment is the key channel through which social comparisons operate. As a result, the social pressure to invest grows more strongly, making comparison motives more potent precisely when parental time becomes more valuable.

At the individual level and in the absence of the comparison motive, the top panels of Figure A5 show that both types of parents increase their time investments, with a somewhat steeper rise for the high-income type. Monetary investment also increases for the high type,

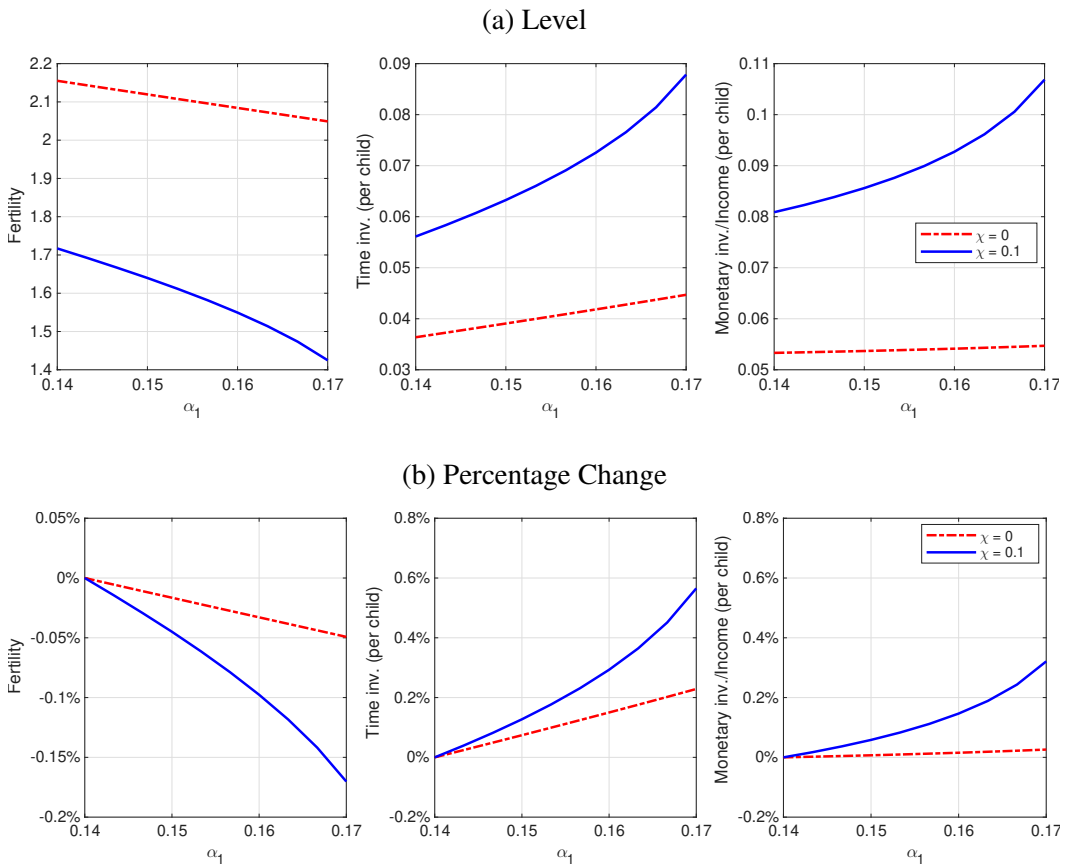
Figure A3: Inequality and Fertility

Notes: The figure plots the Gini index against the total fertility rate of high-income countries with a population of above 5 million in 2020 in the most recent year these data are available. This is 2022 for the U.S.; 2020 for Germany and Switzerland; 2019 for Canada and Norway; 2018 for Australia; 2013 for Japan; and 2021 for every other country. Data come from the World Development Indicators.

while it slightly declines for the low type due to the stronger emphasis on time over money. Consequently, fertility declines for both groups, with a more pronounced drop among the high-income households.

The bottom panels of Figure A5 illustrate the effects when the comparison motive is present. Notably, for the high type, the increases in investment and the declines in fertility are significantly more pronounced—almost exponential. Because the high type effectively sets the benchmark in a status-conscious environment, their rising investment intensifies social comparisons and reinforces their own incentives to invest even more, further discouraging fertility. As a result, the low type also increases monetary investment, in contrast to the case without externalities. These patterns align with recent U.S. evidence showing rising parental time and monetary investment, particularly among wealthier and more educated families (e.g., Blandin and Herrington (2022)). Our model captures how rising returns to parenting, when combined with comparison motives, not only increase investments across income groups but also widen disparities between them.

Figure A4: Aggregate Effects of Returns to Parental Time Investment



Note: All y-axis values in the bottom panels are expressed as percentage changes relative to the baseline level at $\alpha_1 = 0.14$.

I.D. Proof of Result 6

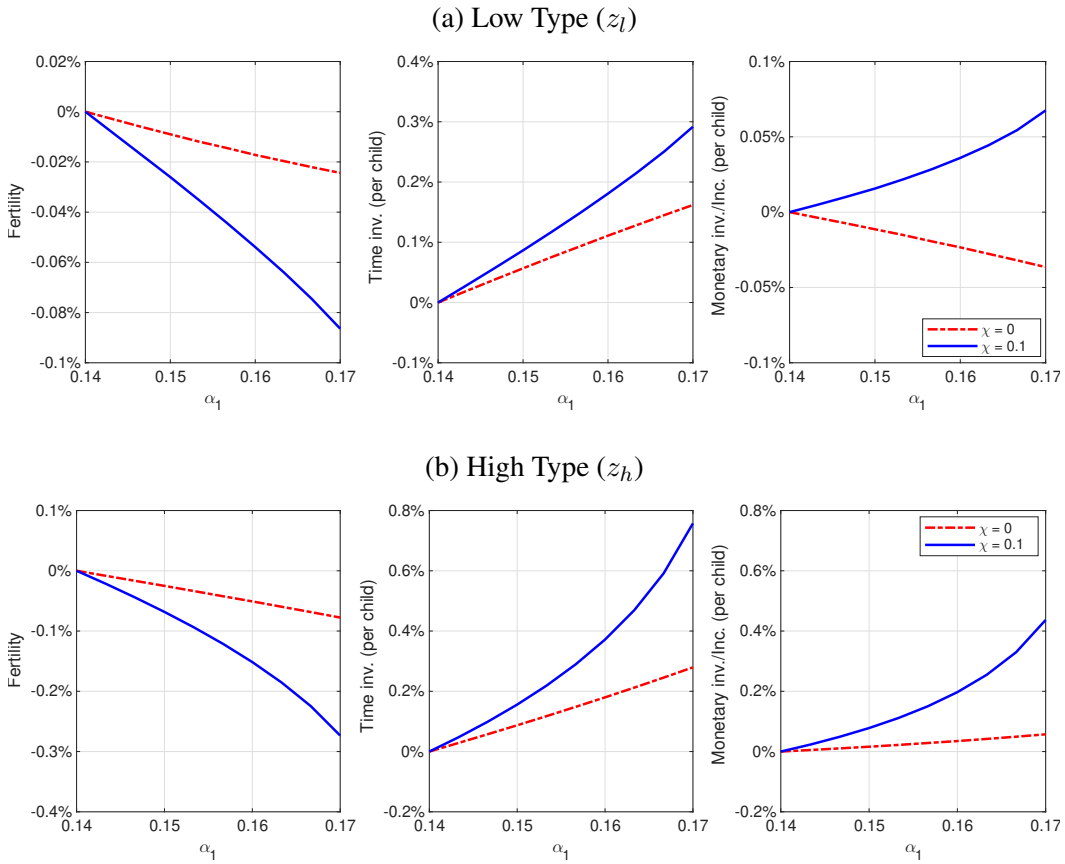
In the presence of the tax and pro-natal transfers, the individual parents, taking $\tilde{h}$ exogenous, solve:

$$\max_{c,n,x} \left[\log c + \omega_n \log n + \omega_h \log\left(h - \chi\tilde{h}\right)\right]$$

s.t.

$$\begin{aligned} c + \tau x n &= (1 - \lambda n - x n) + T n \\ h &= x. \end{aligned}$$

Figure A5: Heterogeneous Effects of Returns to Parental Time Investment



Note: All y-axis values are expressed as percentage changes relative to the corresponding type's baseline level at $\alpha_1 = 0.14$.

The first-order conditions yield the optimal choices:

$$x = \frac{(1+\tau)\omega_n \chi \tilde{h} + (\lambda - T)\omega_h}{(1+\tau)(\omega_n - \omega_h)} \tag{A1}$$

$$n = \frac{\omega_n (\omega_n - \omega_h)}{(1+\omega_n)\left[(\lambda - T)\omega_n + (1+\tau)\omega_n \chi \tilde{h}\right]}. \tag{A2}$$

Imposing the equilibrium condition, $\tilde{h} = h = x$, we can find the decentralized allocations

in equilibrium:

$$x^* = \frac{(\lambda - T)\omega_h}{(1+\tau)\left(\omega_n(1-\chi) - \omega_h\right)} \tag{A3}$$

$$n^* = \frac{\omega_n(1-\chi) - \omega_h}{(1+\omega_n)(1-\chi)(\lambda - T)}. \tag{A4}$$

To achieve the first-best allocations given by Equations (18) and (19), we require τ and T to satisfy the following two equations given λ:

$$\frac{(\lambda - T)\omega_h}{(1+\tau)\left(\omega_n(1-\chi) - \omega_h\right)} = \frac{\lambda\omega_h}{\omega_n - \omega_h} \tag{A5}$$

$$\frac{\omega_n(1-\chi) - \omega_h}{(1+\omega_n)(1-\chi)(\lambda - T)} = \frac{\omega_n - \omega_h}{(1+\omega_n)\lambda} \tag{A6}$$

It is straightforward to show that the two equations are solved when:

$$\tau = \frac{\chi}{1-\chi} \tag{A7}$$

$$T = \frac{\lambda\chi\omega_h}{(1-\chi)\left(\omega_n - \omega_h\right)}. \tag{A8}$$

Note also that the government budget is exactly balanced since

$$\tau x n = T n = \left(\frac{\chi}{1-\chi}\right)\frac{\omega_h}{(1+\omega_n)}. \tag{A9}$$

I.E. Social Planner's Problem with Heterogeneous Agents

We present the social planner's problem for the economy described in Section III.B. Specifically, the planner selects allocations to maximize a weighted sum of individual utilities, using welfare weights denoted by φ_i:

$$\max_{c_i, n_i, x_i, e_i} \sum_{i\in\{l,h\}} \varphi_i \left[\ln c_i + \omega_n \ln n_i + \omega_h \ln\left(h_i - \chi h_h\right)\right] \tag{A10}$$

subject to:

$$\sum_{i\in\{l,h\}}(c_i+e_in_i) = \sum_{i\in\{l,h\}}(1-\lambda n_i-x_in_i)z_i \quad \text{(A11)}$$

$$h_i = h_0+(z_ix_i)^{\alpha_1}e_i^{\alpha_2} \quad \text{(A12)}$$

$$\lambda n_i+x_in_i \in [0,1] \quad \text{(A13)}$$

$$c_i,n_i,x_i,e_i > 0 \quad \text{(A14)}$$

I.F. Proof of Result 8

We will now prove that the conjectured equilibrium is indeed an equilibrium. Since there are b college slots, and the value-added of college increases in ability, the cut-off type is $1-b$. If this type does not invest enough into college preparedness, a lower type will do so and will get accepted instead. Thus, the marginal parent will invest the full surplus, i.e. such that she is indifferent between her child attending college or not. This happens when $p=A(1-b)$.

All other types below the marginal type (i.e. $a<1-b$) will choose $p=0$ as investing less than the marginal type does not get them into college (the signal will still be below the marginal type) and investing more will yield a negative surplus.

All types above the marginal type (i.e. $a>1-b$) will invest just enough to mimic the marginal type, i.e. such that the signal s is identical. For any type a, the investment needed to mimic the marginal type is $p=(1+A)(1-b)-a$. As long as A is large enough, this term is positive for any a. Specifically, we require $(1+A)>\frac{a}{a-b}$ to guarantee strictly positive college preparation investments even for the highest ability type. Note that all types above the cut-off have a strictly positive surplus from going to college. If they lowered their investment just a little bit, their signal would fall below that of the cut-off type and they would no longer get accepted to college. Since in this equilibrium, they get into college for sure, there is no benefit from investing more.

Thus, it was shown that the conjectured equilibrium is indeed an equilibrium. It should also be quite clear that no other equilibrium exists.

Further, the equilibrium is not optimal. The college preparation expenses serve no purpose other than to signal ability. In particular, it does not increase child human capital. A Pareto-improving allocation features no college preparation expenses at all, and still types $1-b$ and above going to college.

B. Data Appendix

II.A. Additional Tables

Table B1: Baseline Parameter Values

Parameter	**Value**	**Description**
α_1	0.15	Production elasticity on time investment
α_2	0.15	Production elasticity on money investment
ω_n	0.5	Curvature of utility from fertility
ω_q	3	Curvature of utility from child quality
λ	0.08	Fixed time cost per child
h_0	1	Baseline human capital
$\bar{z}$	1	Scale of parental wage
δ_z	0.2	Wage dispersion across types

Table B2: Regression Results of Fertility Levels on Comparison Motive Proxies across Countries

Dependent variable	Total Fertility Rate				
	(1)	(2)	(3)	(4)	(5)
Education worries	-0.341***				
	(0.0878)				
Share praising hard work		-0.566**	-0.563*		
		(0.171)	(0.246)		
Total out-of-school lessons				-0.0294	
				(0.0365)	
Study time (paid for)					-0.0553
					(0.0508)
log(GDP p.c.)	-0.104	-0.0726	-0.454*	0.119	0.0992
	(0.0570)	(0.0584)	(0.207)	(0.0599)	(0.0691)
Unemployment rate	-0.00490	-0.0113	-0.0357**	-0.00944	-0.00657
	(0.00652)	(0.00779)	(0.0108)	(0.00733)	(0.00894)
Population(million)	0.000821*	0.000683	-0.00726	0.000219	0.000197
	(0.000332)	(0.000499)	(0.00475)	(0.000663)	(0.000713)
Constant	3.376***	2.659***	7.082**	0.588	0.740
	(0.621)	(0.676)	(2.185)	(0.641)	(0.690)
Country + Year FE	No	No	Yes	No	No
Observations	32	93	93	32	32
R^2	0.315	0.113	0.957	0.120	0.135

Notes: Results of an OLS regression of the total fertility rate on different proxies for the strength of comparison motives in high-income countries with a population of above 5 million in 2020 and country characteristics. Data on TFR, GDP per capita, unemployment, and population come from the World Development Indicators. They are always measured in the same year as the comparison motive proxy. In column (1), we use education worries as a proxy, measured from the World Values Survey data. Concretely, we calculate the average response to the question "To what degree are you worried about the following situation—Not being able to give one's children a good education?" per country, where responses are given on a 4-point scale ranging from 1 "Not at all" to 4 "Very much". In columns (2) and (3), we use a measure of intensive parenting, also constructed from the World Values Survey. Following Doepke and Zilibotti (2019), intensive parenting is measured by the share of respondents in each country who answer that "hard work" is among the most important values when bringing up a child. Columns (4) and (5) present results using two measures of shadow education constructed from the 2012 PISA student suvey: total weekly hours spent on out-of-school lessons in math, science, the local language, or another subject, and weekly hours spent studying with a paid education provider, such as a private tutor or a commercial company. Stars indicate statistical significance levels: $^{*}(p < 0.05)$,** $(p < 0.01)$,*** $(p < 0.001)$.

Table B3: Regression Results of Fertility Changes on Comparison Motive Proxies across Countries

Dependent variable	log TFR change between 2022 and			
	2010	2000	2012	2012
	(1)	(2)	(3)	(4)
Education worries	-0.205*			
	(0.0817)			
Share praising hard work		0.157		
		(0.223)		
Total out-of-school lessons			-0.0458*	
			(0.0172)	
Study time (paid for)				-0.0620**
				(0.0223)
log(GDP p.c.)	-0.160*	-0.0825	-0.134***	-0.151***
	(0.0565)	(0.0793)	(0.0358)	(0.0389)
Unemployment rate	-0.00158	0.00694	0.0102	0.0133*
	(0.00301)	(0.0117)	(0.00651)	(0.00619)
Population(million)	0.000322	-0.0000805	0.0000622	0.00000532
	(0.000319)	(0.000426)	(0.000264)	(0.000260)
Constant	1.960*	0.632	1.341**	1.412**
	(0.681)	(0.941)	(0.400)	(0.420)
Observations	20	29	32	32
R^2	0.450	0.167	0.484	0.495

Notes: Results of OLS regressions of the changes in the logarithm of the total fertility rate on different proxies for the strength of comparison motives in high-income countries with a population of above 5 million in 2020 and country characteristics. Data on TFR, GDP per capita, unemployment, and population come from the World Development Indicators. The dependent variable is always the log difference in TFR between 2022 (the most recent year with complete fertility information for all countries) and the year in which the respective comparison motive proxy was first measured in any country. In column (1), we use education worries as a proxy, which was first measured in 2010. Thus, the dependent variable is the logarithm of TFR changes between 2010 and 2022. In columns (2) and (3), we use a measure of intensive parenting. Although the relevant question was first asked in 1981, we restrict our sample to data post 2000, thus taking the changes in fertility between 2000 and 2022 as the dependent variable. Columns (4) and (5) present results using two measures of shadow education constructed from the 2012 PISA student survey: total weekly time spent on out-of-school lessons and weekly time spent studying with a paid education provider. Since the survey is from 2012, the dependent variable is the log change in TFR between 2012 and 2022. All control variables are always measured in the same year as the comparison motive proxy for each country, which is always the earliest year it is measured in case it is measured more than once during the respective time interval. See the notes to Table B2 for details on the construction of the comparison motive proxies. Stars indicate statistical significance levels: $^{*}(p < 0.05)$,** $(p < 0.01)$,*** $(p < 0.001)$.

Table B4: Regression Results of Birth Rates on Social Capital in U.S. Counties

	Dependent Variable: Birth Rate in 2022 per U.S. County				
	(1)	(2)	(3)	(4)	(5)
Economic Connectedness	-3.831***				-1.925**
	(0.556)				(0.673)
Economic Connectedness (High SES)		-5.304***			-2.479**
		(0.713)			(0.884)
Civic Engagement			-9.766***		-9.097***
			(0.916)		(0.888)
Cohesiveness				-2.316*	1.376
				(0.906)	(0.846)
Personal Income p.c. (10k)	0.380	0.952**	-0.357	-0.849**	1.038***
	(0.285)	(0.295)	(0.262)	(0.275)	(0.261)
Total Employment (100k)	-1.118***	-0.877***	0.252	-0.535*	-0.232
	(0.255)	(0.260)	(0.316)	(0.253)	(0.362)
Population (100k)	0.702***	0.654***	-0.329	0.326	0.0243
	(0.170)	(0.182)	(0.219)	(0.175)	(0.253)
Observations	566	566	566	566	566
R^2	0.154	0.179	0.272	0.056	0.368

Notes: Results of OLS regressions of Birth Rates of U.S. counties in 2022 on measures of Social Capital in that county, based on data and definitions from Chetty and others (2022) and county characteristics. Economic Connectedness measures two times the share of high-SES friends among low-SES individuals, averaged over all low-SES individuals in the county. Economic Connectedness among high-SES individuals, measures two times the share of high-SES friends among high-SES individuals, averaged over all high-SES individuals in the county. A county's cohesiveness is calculated as the average fraction of an individual's friend pairs who are also friends with each other. Civic Engagement is measured using the number of Facebook Pages predicted to be "Public Good" pages based on page title, category, and other page characteristics, per 1,000 users in the county. All measures of Social Capital are standardized to have mean zero and standard deviation one. Birth Rate data come from the the Center for Disease Control and Prevention, National Center for Health Statistics and are calculated as the number of births by 1,000 women aged 15–44 years old in the given year. Only counties with a population of 100,000 persons or more are shown. County-level income, employment and population data come from the U.S. Bureau of Economic Analysis, regional economic accounts. All data is from 2022. All regressions include a constant. Stars indicate statistical significance levels: $^{*}(p < 0.05)$,** $(p < 0.01)$,*** $(p < 0.001)$.

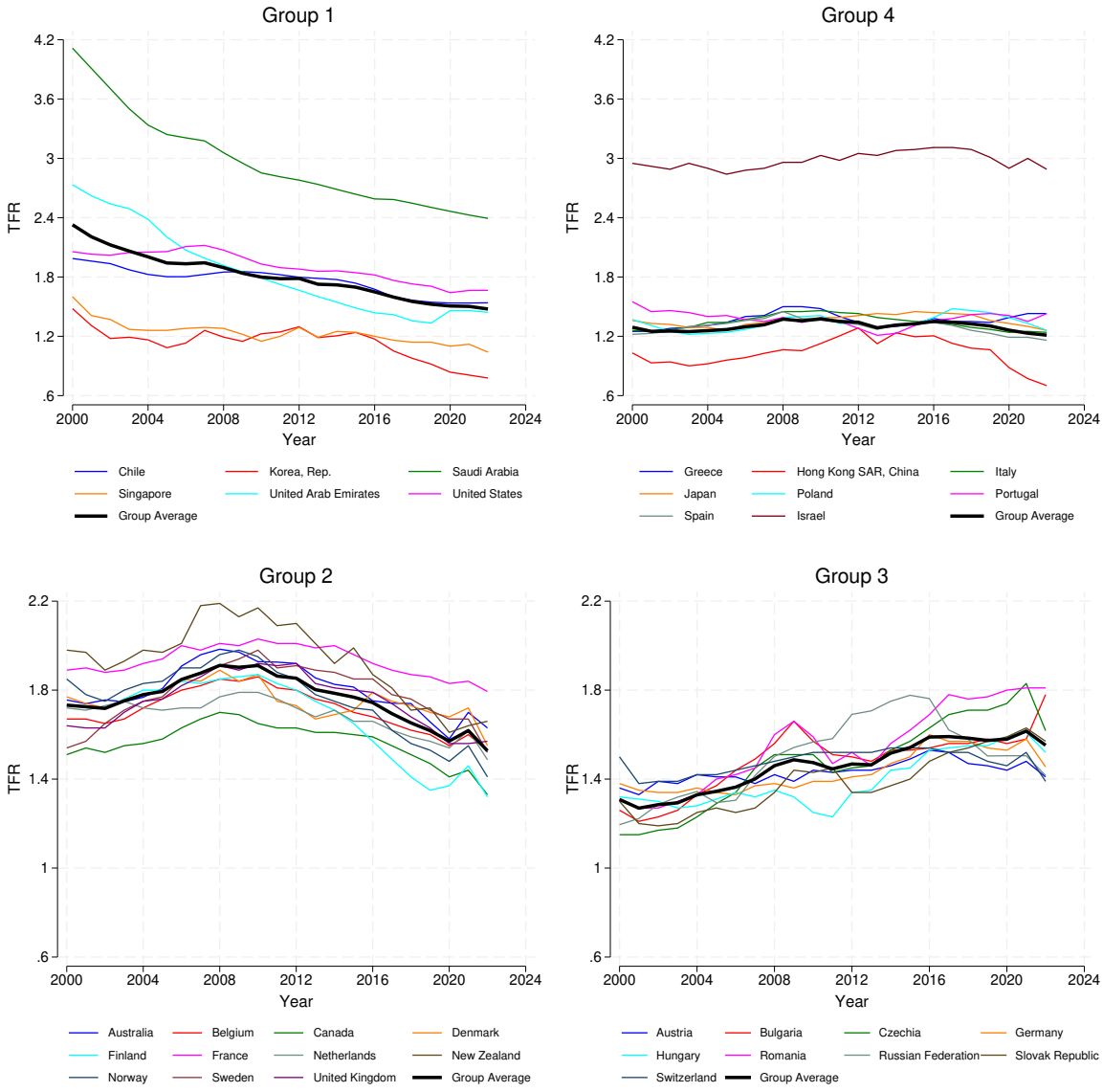
Table B5: Regression Results of Birth Rates on College Competitiveness in U.S. States

	(1) Birth Rate 2007	(2) Birth Rate 2019	(3) Birth Rate 2019
Competitiveness Index	-12.26***		
	(2.302)		
AP Exams per student		-29.70***	
		(6.304)	
CL Admission Rate			26.60**
			(7.940)
Log GDP	0.0257	0.952	0.565
	(2.215)	(1.579)	(1.648)
Total Employment (million)	0.246	-0.0130	-0.139
	(0.542)	(0.224)	(0.229)
Population (million)	-1.304	0.0899	0.919
	(3.008)	(1.378)	(1.395)
Observations	51	51	51
R^2	0.200	0.283	0.195

Notes: Results of OLS regressions of Birth Rates on measures of college competitiveness in U.S. states and state characteristics. Column (1) uses the Competitive Pressure Index from Bound and others (2009). The index is calculated as the sum of the fractions of students in each U.S. state (in 1992) who engaged in behaviors such as taking the PSAT, taking an AP exam, spending 10 or more hours on homework per week, using private test reparation services, and applying to five or more colleges. Column (2) uses the number of Advanced Placement Exams taken per student in 2019. Column (3) uses the average Admission Rate of 4-year colleges in each U.S. state in 2019. Birth Rate data come from the the Center for Disease Control and Prevention, National Center for Health Statistics and are calculated as the number of births by 1,000 women aged 15–44 years old in the given year and state. Data on Population, Employment and State GDP come from the U.S. Bureau of Economic Analysis, regional economic accounts. All data used in Column (1) are from 2007. All data used in columns (2) and (3) are from 2019. All regressions include a constant. Stars indicate statistical significance levels: $^{*}(p < 0.05)$,** $(p < 0.01)$,*** $(p < 0.001)$.

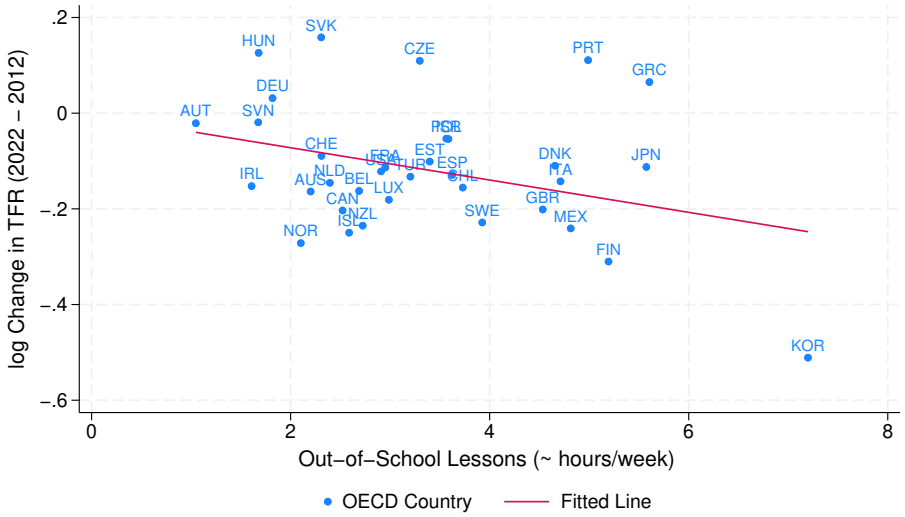
II.B. Additional Figures

Figure B1: Total Fertility Rate Evolution in different Groups of High-Income Countries



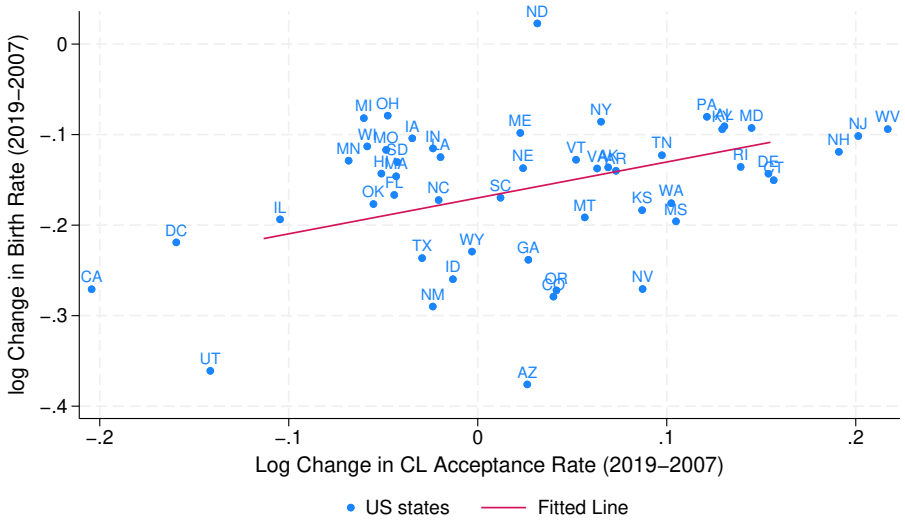
Notes: Time series are the unweighted average evolution of the total fertility rates of all countries in a group. Only high-income countries with a population larger than 5 million in 2020 were included. The average TFR time series of countries in Group 4 was calculated without Israel, but Israel is added here for completion. Note that the top and bottom panels have different y-axis scales.

Figure B2: "Shadow Education" and Fertility Change across OECD countries



Notes: Data on the number of hours spent on out-of-school lessons in math, language, science, or other per week (i.e., "Shadow Education") in OECD countries. Data comes from the PISA 2012 student survey.

Figure B3: Birth Rate Change and College Acceptance Rate Change in U.S. States



Notes: Relationship between the change in the logarithm of average acceptance rates of 4-year colleges between 2007 and 2019 and the change in birth rates in the same time in U.S. states. See Table 3 for a description of the variables and data sources.