Birth Timing and the Intergenerational Transmission of Human Capital

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Arbitrary age-cutoff dates used for eligibility in schooling and organized sports create differential opportunities for children that can have long-term consequences. These opportunities, in turn, provide incentives for birth-date targeting. I study a setting in which being born just after the cutoff date is highly advantageous relative to being born late in the eligibility year. Using an exogenous change in the cutoff date, I obtain causal evidence showing how birth timing at conception responds to memory-based salient incentives: certain parents target birth dates to ensure that their children are among the oldest in the eligibility year.

> The accident of birth is a principal source of inequality. Birth is becoming fate.
>
> (Heckman 2013, 3)

> Most sons want to be like their fathers and I was no exception. . . . Every parent wants to give his child everything he didn't have, everything he had to struggle for. I was no different.
>
> (Pelé 2006, 33, 195)

I. Introduction

Parental priorities translate into economic outcomes for children, and parents make some of the important choices that influence the economic

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success of their children. Beginning with at least Becker and Tomes (1979, 1986) and Becker (1991), an important literature studies the intergenerational transmission of human capital, earnings, and status, and much empirical evidence documents the existence of a strong parental effect in the formation of the offspring's human capital.[1] The evidence also points to the important role that parental-specific human capital plays on the transmission of social traits and demonstrates the existence of a substantial "dynastic bias."[2]

This paper studies a choice that parents may make: the time of birth of their children. Thus, while an important and voluminous literature is concerned with the consequences of the "accident of birth," this paper studies how this accident may respond to human capital incentives. Put differently, the accident of birth need not be so.

Specifically, I take advantage of well-known important incentives that, to the best of my knowledge, have remained unexplored from this perspective: relative age effects. In the human capital literature, the basic finding on these effects is that arbitrary cutoff dates for school eligibility can have long-term effects for student performance and human capital accumulation because they cause some students (those born just after the cutoff date) to be older and more mature than others (those born just before the cutoff date) when they begin school. Because skills accumulated in early childhood complement later learning (Cunha et al. 2006), relative age differences at the start of formal schooling can be long-lasting if relatively older students are better positioned to accumulate more skills in the early grades because of their cognitive and emotional maturity advantage. The first paper noting this effect appears to be Williams et al. (1970) in English data. Importantly, Bedard and Dhuey (2006) confirm this basic hypothesis by providing strong evidence that early relative maturity effects have a long-lasting effect on student performance.[3]

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[1] Mulligan (1997) reviews and extends this literature by developing a theory of intergenerational mobility and parental priorities with endogenous altruism. There is also a large sociological literature on intergenerational occupational mobility, status, and income. See Breen and Jonsson (2005) for a review.

[2] On the role of parental-specific human capital, see, for instance, Solon (1999, 2018), Björklund, Lindhal, and Plug (2006), Björklund and Jäntti (2009), Black and Deveraux (2011), and references therein. "Dynastic bias" is defined as the percentage of subjects in a given occupation whose fathers are in the same occupation relative to the share of the population in that occupation. Its value is 1 when the profession of subjects is independent from those of their fathers. Dal Bó, Dal Bó, and Snyder (2009) compute the "dynastic bias" for occupations in the United States and find an average bias for all occupations (weighted by occupation size) of 9.1. For specific occupations they find, for instance, 5.4 for carpenters, 9.9 for electricians, 14.2 for dentists, 25.5 for doctors, 34.4 for economists, and 255.6 for legislators in the US Congress.

[3] They estimate that the youngest members of each cohort score 4–12 percentiles lower than the oldest members in grade 4 and 2–9 percentiles lower in grade 8 in Organization for Economic Co-operation and Development countries. The youngest members of each cohort in the United States and Canada are also less likely to attend university. See also Bedard and Dhuey (2012) and Black, Devereux, and Salvanes (2011).

Empirical support for the idea that arbitrary eligibility-cutoff dates can have sizable consequences is perhaps even stronger in sports programs where, in addition to cognitive and emotional development, physical development also plays an important role. Youth sports are typically organized by age brackets according to a cutoff birth date. Nowadays, for instance, in US and most European youth soccer leagues, the cutoff date is January 1. Therefore, players born in January are likely to be on average stronger, bigger, more coordinated, and more mature than players born in December of the same year. Because several months of development can make a huge difference, these players tend to perform better and are more likely to be identified as talented than those born in the later part of the eligibility year. Once selected, they may then benefit from more and higher-quality coaching, deliberate practice and experience, and may be given more opportunities for further advancement.

Barnsley, Thompson, and Barnsley (1985) provided the first major study of what came to be known as the "relative age effect." They found that players in the National Hockey League (NHL) were more than four times more likely to be born in the first three months of the calendar year than in the last three months. This skewed birth distribution over-representing individuals born early in the selection year relative to individuals born in the later part of the year is a phenomenon that has since then been documented extensively for many sports, in many countries, and found to be prevalent in youth and senior competitions.[4]

Thus, the evidence in both the human capital and sports literatures strongly supports the hypothesis that arbitrary eligibility cutoffs can have long-term consequences on human capital accumulation and adult outcomes. The origins are found in the early childhood environment, in particular in the early differences in cognitive, physical, and socioemotional development associated with age differentials. An important body of research confirms that life success may critically depend on the cognitive and noncognitive skills acquired in this environment and that early interventions can improve initially troubling results (Heckman 2013).[5]

Motivated by these literatures, I study the incentives for an unusual "intervention": birth-date targeting at conception as a response to the benefits that eligibility-cutoff dates provide for specific human capital formation and transmission.

[4] Any review of this extensive literature readily shows strong evidence in baseball, soccer, ice hockey, rugby, tennis, and other sports. See, for instance, Musch and Grondin (2001) and references therein. Dudink (1994) seems to be the first author to document these effects in the setting that I study.

[5] Many programs that target the early years seem to have the greatest promise by changing the values and motivations of the child. Early environments play a powerful role in shaping adult outcomes, and several studies demonstrate substantial positive effects of early environmental enrichment on a range of cognitive and noncognitive skills, school achievement, and social behaviors. See García et al. (2020), Gertler et al. (2014) and references therein.

The setting is an organized sports environment that affords useful insights because of four important advantages. First, as just indicated, in addition to cognitive and emotional maturity, physical development also plays an important role, and physical differences are readily observable and easily identifiable by both participants and observers alike. Specifically, the setting concerns European youth and professional soccer. This is a context in which a number of studies have found large relative age effects in every country at all levels, from youth leagues that begin with children under 9 years old to senior professional leagues.[6] Second, a uniquely rich dataset on birth dates and demographic characteristics for both parents and children can be gathered from the Asociación de Futbolistas Españoles (AFE) in Spain. Third, in terms of incentives, the Spanish leagues are particularly interesting because they are highly competitive, and the incentives for participants are high at all levels. Spain's professional soccer league is among the top in the world, not only in soccer but in any sport, and similar success and high incentives are also found at the youth and amateur levels.[7] Spain, for instance, tops the ratio of European-qualified youth and senior coaches across European countries.[8] Fourth, and very important, I can take advantage of an exogenous change in cutoff dates used for eligibility. This policy change creates an ideal variation to identify causal effects of incentives on birth timing at conception.

As anticipation of the results, I find parents who appear to disproportionately plan births to take advantage of the opportunity provided by relative age affects. In particular, certain parents who experienced themselves the disadvantage of the cutoff dates when they were playing (they were born in the later part of the eligibility year) target birth dates aimed at ensuring that their children are among the oldest in the eligibility year. They appear to want to make sure that their children have what they did not have: a "good" birth date. Across the different divisions and levels, the effect gets stronger as we move from professional leagues to semiprofessional leagues, that is, as we move toward subjects who "marginally" did not make it to the professional level. On the other hand, parents who

[6] See, e.g., Helsen, Van Winckel, and Williams (2005) and references therein.

[7] In terms of performance in international club competitions, the top professional division, *La Liga*, is the top soccer league in the world over the past two decades according to standard metrics of strength and success. It attracts many of the superstar players from around the globe and pays some of the highest salaries. In terms of average spectator attendance, it is the third-highest league among professional soccer leagues in the world (behind Germany's Bundesliga and England's Premier League) and the fifth highest among domestic professional sports leagues (in all sports).

[8] This is not surprising because sports that achieve success on the international stage typically place great emphasis on quality coaching throughout the player-development pathway. In Spain, the ratio of Union of European Football Associations (UEFA)-qualified coaches to active players is 1 to 17; thus, the system of coaching and player development is strongly enhanced so that players are proficiently coached from a young age. In Italy this ratio is 1 to 48, in Germany 1 to 150, and in England 1 to 812. See "Football Coach Shortage Paints Bleak Picture for England's Future" by Matt Scott in *The Guardian*, Tuesday, June 1, 2010.

themselves benefited from these opportunities when they were playing do not appear to respond to these incentives: the distribution of the birth dates of their children is statistically no different from that of the population at large.

To make sure that these findings cannot be attributed to seasonality effects, special demographic characteristics of the population under study, marriage patterns, or other reasons, I take advantage of an exogenous change in the cutoff date. Beginning in the 1995–96 season, the cutoff date for sports eligibility in Spain was moved from August 1 to January 1 for exogenous reasons. I find that when the cutoff date is changed, the same class of parents (those who "suffered" themselves a "bad birth date") react by adapting their choice of their children's birth date accordingly. And again, parents who benefited from these opportunities themselves do not respond to the change in the cutoff date. These results represent, to the best of my knowledge, the first causal evidence in the literature showing that birth timing at conception responds to incentives. This is important among other reasons because the study of the intergenerational transmission of socioeconomic status more often than not relies on correlation studies. This is the first main contribution of the paper.

Second, the differential responses across parents who had different experiences themselves is interesting in its own right. The reason is that it is not trivial to explain the observed heterogeneity in responses. Why are they found for some groups and not for others? Does this have to do with differences in information? Or is it due to differences in beliefs? And if so, why are there such differences? To answer these questions, I propose a memory-based model of salient incentives as consistent with the main features of the data. Models of salience have been recently developed in the decision-making literature (Bordalo, Gennaioli, and Shleifer 2012, 2013, 2020) but to the best of my knowledge have not been linked to the literatures just discussed. As such, this empirical setting opens up a set of new important areas for applicability. I postpone a more thorough discussion until section V after the empirical results are presented.

Third, the results are deeply connected with the empirical literatures on parental human capital transfers and mediation, birth-date seasonality, birth-date manipulations, redshirting, early-childhood interventions, and "nonaccidental" selection of children's characteristics at birth. I briefly review these literatures in the next section as a prelude to the empirical analysis. In each case, I first note the extent to which the results are in line with these literatures and then highlight the sense in which they provide a novel contribution to them.

Fourth, the evidence suggests that physical maturity advantages may complement the cognitive and emotional maturity advantages that are particularly important in human capital environments. As a policy implication, such a complementarity would suggest that sports settings could represent a useful new source of childhood stimulation intervention if chosen carefully. Finding new sources of complementarities is important as shown in a wide-ranging literature concerned with social and educational policy directed toward the malleable early years with the goal of promoting the early-life environment (Heckman 2013).

Finally, besides the literatures just discussed, the evidence is consistent with the more general principle that agents respond to incentives "relentlessly applied with great theoretical and empirical success" in all fields, including labor economics and the economics of the family (Heckman, 2017). The observed responses to incentives, however, add three novelties: (i) the stage of childhood for investments is not after but before the child is born, therefore adding a new "stage"; (ii) the investment form involves neither time nor expenditures, as typically considered, but a radically different investment, a birth date; and (iii) in addition to standard cognitive and noncognitive skills, the investments include "perceived" physical development, which matters for performance and in the selection process.

Overall, in terms of external validity, the results are strongly suggestive that rational responses to salient incentives can play an important role in what are large and active bodies of research from the perspectives just discussed. That is, although the results may be of interest to those intrigued by the sporting context, they can be emphasized at least as suggestive of similar forces operating in a range of contexts involving long-term planning, human capital investments, and intergenerational transmission.

II. Related Literature

In addition to the main literature briefly discussed thus far, this paper enhances other strands of specific research areas. I briefly discuss them next, noting the distinctive sense in which it contributes to them:

1. Intergenerational human capital transfers and parental mediation. Human capital transfers across generations play a critical role in the endogenous growth literature. In many models, human capital is the engine of growth, and generations are linked through material and emotional interdependencies within the family. Early important contributions include those by Becker, Murphy, and Tamura (1990), where the discount rate between generations is determined by the degree of parental altruism toward each child, and by Ehrlich and Lui (1991), where parents invest in their children to achieve both emotional gratification and old-age support, determined through self-enforcing implicit contracts. In these papers and related literature (see Ehrlich and Lui 1997; Galor and Weil 2000), altruism is the key general motivating force underlying the growth and development process, and the specific motivating factors that link successive generations matter for predictions. Viewed from this perspective, Becker et al. (2018), Cunha and Heckman (2007), and others have studied the important role of complementarities between specific

parental human capital and investments in children. Consistent with their findings, parental responses mediate these complementarities in this setting. However, observed behavior here represents an unusual form of mediation: birth timing at the time of conception to provide a permanent endowment in children (a birth date).

2. Birth seasonality and weather. There is a venerable literature that studies seasonality in birth.[9] Early studies focused on conditions at conception such as weather, while more recent work finds patterns showing how conditions at the anticipated time of birth (in particular, expected weather at birth) and how maternal characteristics may play an important role in explaining seasonality in fertility outcomes, while conditions at conception may have less explanatory power.[10] In this paper, birth planning is also determined by expected conditions at birth, but it is not the weather or other environmental variables. Instead, it is determined by "relative age conditions," which are in turn determined by altruistic reasons and specific human capital opportunities for children.[11] This seasonality is also associated with paternal characteristics, not with maternal characteristics, an aspect that as Almond, Currie, and Duque (2018) note is understudied: "To date, most of the literature focuses on the role of mothers, largely because we have had much better information about mothers than about fathers. . . . [Studying the role of fathers] is only just beginning."
3. Immediate short-term manipulation of "exact" birth date. There is a literature that documents how conditions such as tax benefits, onetime monetary bonuses, and other financial considerations—or even "auspicious" birth dates associated with superstition—that may require short-term planning to shift a few days the exact day

[9] See, e.g., Lam and Miron (1991) and Lam, Miron, and Riley (1994).

[10] For conditions at conception, see Barreca, Deschenes, and Guldi (2018) and references therein. These authors also note that while temperature shocks (e.g., days above 80°F) may cause a decline in birth dates approximately 8–10 months later, the decline is followed by a partial rebound in births over the next few months. This is consistent with the hypothesis that populations may dynamically adjust by shifting the conception month. For conditions at the anticipated time of birth, these aspects explain seasonality in many animal species, including "seasonal breeders" that mate at times of the year that allow for birth at a time optimal for survival in terms of temperature and food and water availability and "opportunistic breeders" that mate only when such conditions are favorable. With respect to explanatory power, an important question concerns selection. Currie and Schwandt (2013) focus on births to the same mother to provide selection-free estimates of seasonal patterns in birth weight and gestation. Buckles and Hungerman (2013) find that children born at different times in the year are conceived by women with different socioeconomic characteristics and that the seasonality in maternal characteristics is driven by high socioeconomic status disproportionately planning births away from winter. See also Shigeoka's (2015) study in Japan and Régnier-Loilier's (2010) study in France. Clarke, Oreffice, and Quintana-Domeque (2019) report novel correlates of maternal characteristics with season of birth in US data.

[11] For the same reasons that Aliprantis (2012) notes for the case of redshirting, use of quarter of birth as an instrument when parents are engaged in birth timing "makes estimates obtained through this identification framework all but impossible to interpret."

of birth can be a relevant determinant of birth timing.[12] The primary means by which birth is a choice variable in the very short run (i.e., of medically manipulating the exact date of birth) are Cesarean section deliveries and inducement of labor (birth scheduling). In this paper, however, birth timing is instead determined by long-term planning at the time of conception and also by a different type of consideration: specific human capital opportunities for children in the same occupation the father participated in. Birth timing originated at conception operates as an instrument for the transmission of human capital opportunities, possibly including the transmission of preferences (Mulligan 1997).

4. Policy: Early-childhood circumstances and interventions. As mentioned earlier, there is a very important literature on early-childhood intervention that focuses on understanding what types of policy interventions can improve early learning environments for children, especially for those from disadvantaged backgrounds, and augment their skill levels (see, e.g., Aizer and Doyle 2014; Heckman and Mosso 2014; Elango et al. 2015; García, Heckman, and Ronda 2023). As in this literature, I study an "intervention" that targets the early years. But different from the standard type of intervention, it does not target specific years after the child is born, typically from kindergarten to high school. Instead, it takes place before kindergarten, actually even before the child is born. This intervention is not determined by public or social policy but simply by parents attempting to give their children a more advantageous environment that would foster their specific human capital formation opportunities in a given setting or occupation.[13]
5. Redshirting. In principle, a student's age can be manipulated not only via birth timing but also via redshirting. In the education literature, redshirting refers to the decision of parents and teachers who choose to keep children out of kindergarten or first grade even when

[12] Dickert-Conlin and Chandra (1999) find that when the tax system increases the benefits of a late-December relative to an early-January birth, parents who were already expecting a child around the end of the year respond to these incentives. See also LaLumia, Sallee, and Turner (2015) and Schulkind and Shapiro (2014). Crump, Goda, and Mumford (2011) find no effect of taxes on total fertility but an effect on timing over the life cycle, in particular with a 2-year lag. Gans and Leigh (2009) find that parents moved forward June deliveries to become eligible for a newly introduced one-time "baby bonus" in Australia. Almond et al. (2015) document how Chinese-American births in California occur disproportionately high on the 8th, 18th, or 28th day of the month, as the number 8 is considered lucky in Chinese culture. This is driven by a "too high" number of C-sections on these "auspicious" dates. Berlinski, Galiani, and McEwan (2011), Dickert-Conlin and Elder (2010), and McEwan and Shapiro (2008) find no evidence of manipulation of the exact birth date around school cutoff dates in Argentina, the United States, and Chile, while Shigeoka (2015) estimates that in Japan, more than 1,800 births may have been shifted from 1 week before to 1 week after the school-entry cutoff.

[13] Almond, Curry, and Duque (2018) provide an excellent survey of the literature on the impact of the early-childhood postnatal environment. There is also an important literature on the relevance of the conditions during pregnancy, including the interventions to improve these conditions.

they are legally eligible to attend. It is also referred to as "the gift of time." In their review, Deming and Dynarski (2008) show that about three-quarters of the steady increase in the age at school entry in the United States over the past few decades reflects these decisions. The perception is that children who are allowed to mature for another year will benefit more from their schooling. Indeed, older children tend to perform better academically than younger ones at any grade, although it is unclear whether delaying school entry may have long-term, positive effects on adult outcomes such as IQ, earnings, or educational attainment. By contrast, there is substantial evidence that "like the research on competitive athletes, relative age provides an advantage in rank-order tournament competitions, which characterizes admission to elite schooling tracks, selective universities, and competitive sports teams" (see Bedard and Dhuey 2006; Datar 2006; Puhani and Weber 2007). In the sports setting I study here, redshirting is not possible, and so parents' only choice to manipulate their children's relative age is through birth timing. In section V, I develop a simple conceptual framework that captures the basic similarities and differences between redshirting and birth timing, as both may be possible in settings such as schooling.

6. Nonaccidental choice of children's characteristics. Following seminal work by Sen (1990, 1992), the "missing women" phenomenon refers to the fact that in many Asian countries, such as India, China, and South Korea, the ratio of men to women is particularly skewed. The literature traditionally relates this fact to a preference for sons over daughters, and research has provided empirical evidence of sex-selective abortion, female infanticide, and excess female mortality in childhood (see, e.g., Calvi 2020; Almond, Li, and Zhang 2019; and references therein). Das Gupta (2005) offers an early overview of this literature. Dahl and Moretti (2008) also provide substantial evidence supporting the notion that parents in the United States favor boys over girls, and Edlund (1999) models endogenous sex choice and examines its consequences. The "nonaccidental" choice of month of birth I study here adds a different characteristic to this literature on nonaccidental choices. This characteristic also reflects a different type of motivation by parents and obviously involves a different technology as well as selection at a different time (conception).

III. Data

A dataset with demographic and family-information data, including birth dates for parents and children, is obtained from the Association of Spanish Footballers (AFE) for 7,251 players and their 11,579 children. The dataset includes players who participated in professional and semiprofessional competitions during the period 1976–2015. As in other countries, league competition in Spain is hierarchical. It has three professional divisions:

Primera Division (known as *La Liga*), which has 20 teams; Segunda Division A, which has 22 teams; and Segunda Division B, which has 80 teams divided into four groups of 20 teams each. I refer to all the Segunda Division teams as *La Liga2*. The next division in the hierarchy, Tercera Division, comprises 360 teams and about 9,000 players in a given season. It is semiprofessional in that it includes some players who have earnings similar to the average household salary in Spain and a significant share earning above minimum wages. Teams in divisions lower in the hierarchy play in regional leagues and often receive some financial remuneration (e.g., small bonuses per win) but rarely have any professional players. In the 2022–23 season, there are about 125,000 officially registered senior players (aged 18 and above) in these lower leagues. In terms of youth programs, there are about 800,000 official licenses for children and youth aged 8–18, and competition is typically grouped into eight different age categories.[14] All the leagues (professional, semiprofessional, regional, and youth) adhere to the same structure and calendar schedule and are governed by the same rules of the world-governing body of soccer, Fédération Internationale de Football Association (FIFA).

In addition to identity and birth-date information, the dataset includes various characteristics of the parents such as birthplace, nationality, marital status, and home address. I further conducted two surveys on all the players listed in the AFE dataset. I obtained the responses for 1,717 and 2,027 subjects, respectively. The first survey asks for information about their children in relation to the following variables: participation in official organized soccer leagues, schooling performance at the end of preschool, primary school, and middle school (ages 6, 12, and 16), and performance in the national standardized scholastic-achievement tests ("Selectividad") required to enter college (age 18). The second survey explicitly asks about their "coding" of relative age effects, their recollection of these effects, and their incentives at the time they were planning to have their children.

Data on birth-date frequencies for the general population are obtained from Instituto Nacional de Estadística (INE)[15] and for youth and senior (amateur and professional) players from the annual club-player registration forms (*fichas*) of the Real Federación Española de Fútbol (RFEF).

IV. Empirical Evidence

A. *Relative Age Effects*

Before studying the main dataset, I first confirm the existence of a relative age effect in this setting by reporting the quarter of birth of players who

[14] These go initially from one category per year (from U9 [under 9 years old] to U14), to two final categories covering 2 years each (U16 [15–16 years] and U18 [17–18 years]) before they become senior players.

[15] The microdata on birth-date certificates from 1975 to the present can be obtained from the "Demografía y Población" section at https://www.ine.es/dyngs/INEbase/es/listaoperaciones.htm.

have participated in youth, amateur, and professional leagues during the same four decades 1976–2015. Table 1 reports the quarter of birth of 27,361 players by using the information in the annual club-player registration forms of the RFEF, including 11,982 professional players. Unfortunately, these forms do not contain family information. I also report the quarter of birth of the population at large in Spain during the same period.

The evidence is straightforward. The right-most column reports the *p*-values of the tests that compare the birth distribution of a given set of players with that of the overall population. Not surprisingly, as already documented in the literature in this sport in Spain and in other countries and also in other sports, the pattern is unmistakable: from the first quarter after the age-cutoff date to the last quarter, there is a steady decline in the likelihood that a child born in that quarter will become a professional player, a semiprofessional player, or will even participate in organized soccer at the amateur senior level (regional leagues) or at the youth levels from ages 9 to 18.

TABLE 1
Relative Age Effect among Soccer Players: Distribution by Quarter of Birth

Subjects	Observations	Quarter of Birth (%) Q1	Q2	Q3	Q4	Test of Equality of Birth Distributions: Players vs. Population (χ^2 Test *p*-Value)
Senior soccer players:						
Professional *La Liga* players	4,240	.318	.301	.254	.127	<.01
Professional *La Liga2* players	3,217	.335	.274	.213	.178	<.01
Semiprofessional players	4,525	.348	.292	.192	.168	<.01
Amateur regional players	8,342	.298	.285	.240	.177	<.01
Youth soccer players:						
Ages 15–18	2,311	.315	.285	.235	.165	<.01
Ages 15–18[a]	312	.365	.287	.203	.145	<.01
Ages 12–15	1,294	.310	.272	.253	.165	<.01
Ages 10–12	870	.362	.284	.187	.167	<.01
Ages 8–10	2,251	.315	.253	.241	.191	<.01
Spain population:						
Years 1976–2015		.244 (.01)	.252 (.01)	.256 (.01)	.247 (.01)	

Note.—This table reports the percentage of subjects born in a given quarter during the period 1976–2015. Quarters 1–4 (Q1–Q4) represent the first, second, third, and fourth quarters after the cutoff dates for the soccer players (RFEF dataset). For the overall population in Spain (last row), each quarter corresponds to that of the calendar year (i.e., quarter 1 is January–March, quarter 2 is April–June, and so on). The right-most column reports the *p*-value of the proportions test that compares the distribution of births by quarter vs. the population at quarterly frequencies. Yearly standard deviations are shown in parentheses.
[a] Subjects who have played for the Spanish national team in U18 competitions.

B. *Distribution of Children's Birth Dates by Father Types*

Next, I turn to the AFE dataset. Table 2 reports the quarter of birth of the children of soccer players, sorted by the highest division level that the father reached, relative to the population. Q1 refers to the first quarter (first 3 months after the cutoff date), Q2 to the second quarter, and so on.

As can be seen, it is not possible to reject the hypothesis of equality of quarter-of-birth distributions for all players at the top professional division (*La Liga*) relative to the population at large (p-value = .56).

TABLE 2
Distribution of Children's Births Relative to Population

		Children					
	Fathers (Observations)	Born in Q1	Born in Q2	Born in Q3	Born in Q4	Observations	Test of Equality of Birth-Quarter Distributions (χ^2 Test p-Value)
Professional *La Liga*:							
Born in quarter:							
Q1	450	.982	1.023	.988	.976	647	.76
Q2	421	1.022	1.031	1.010	.987	602	.52
Q3	365	1.028	1.028	.994	.955	518	.44
Q4	173	1.010	1.021	.975	.958	247	.55
All	1,409	1.021	.990	.988	1.002	2,014	.56
Professional *La Liga2*:							
Born in quarter:							
Q1	510	1.019	1.013	.992	1.012	764	.56
Q2	496	1.032	.999	1.030	.987	757	.32
Q3	407	1.048	1.028	.989	.984	607	.14
Q4	212	1.061	1.032	.975	.892	327	.02
All	1,625	1.032	1.021	.980	.967	2,455	.06
Semiprofessional:							
Born in quarter:							
Q1	1,242	1.245	1.103	.924	.728	2,092	<.01
Q2	1,191	1.331	1.124	.848	.697	2,002	<.01
Q3	997	1.459	1.145	.763	.633	1,701	<.01
Q4	787	1.690	1.301	.768	.241	1,331	<.01
All	4,217	1.403	1.152	.836	.699	7,126	<.00
Amateur:							
Born in quarter:							
Q1	737	.993	1.013	1.014	.989	1,298	.72
Q2	720	1.028	1.014	.988	.977	1,287	.61
Q3	676	1.039	1.015	.973	.966	1,319	.30
Q4	633	1.049	1.031	.968	.921	1,245	.12
All	2,766	1.017	.995	1.010	.988	5,149	.77

Sources.—Data on professional and semiprofessional players come from the AFE. Data on amateur players come from a smaller dataset available from the Federación Vasca de Futbol (FVF), which has incomplete information on birthplace, marital status, and other characteristics.

Note.—This table reports the ratio of the percentage of children born in a given quarter relative to the percentage born in the population in that quarter during 1976–2015. Quarter 1 (Q1) represents the first 3 months after the cutoff date: until 1995, this is the period August 1–October 31 and after 1995 the period January 1–March 31. Quarters 2, 3, and 4 (Q2, Q3, Q4) are the second, third, and fourth quarters after the cutoff dates. The rightmost column reports the p-value of the proportions test that compares the distribution of births by quarter vs. the population.

The data, however, show that for all professionals at the next level, and especially for all players that reached the semiprofessional level, the distribution is not similar to that in the population: from the first quarter after the cutoff date to the last quarter, there is a substantial decline in the likelihood of children's birth dates. For all professionals that reached *La Liga2* (Segunda Division 2A and 2B), the difference is significant at the 10% but not at the 5% significance level (p-value = .06), whereas for all semiprofessional players, the difference is strongly significant at standard significance levels (p-value < .001). Finally, for all players who reached amateur regional leagues, the distribution is no different from the population (p-value = .77).

Perhaps the most interesting aspect is that concerned with the heterogeneity across quarters of birth of the fathers:

i. For professional players that reached *La Liga*, the p-values of the tests of equality of distributions relative to the population are not significant at standard confidence levels for any quarter of the eligibility year.
ii. For professionals that reached *La Liga2* but not *La Liga*: (1) the p-value of the tests of equality of distributions relative to the population decrease as we move from parents born in the first quarter of the eligibility year to parents born in the last quarter, and (2) for fathers born in the last quarter of the eligibility year, the difference in quarter of children's birth distributions is significant at standard confidence levels (p-value < .05).
iii. The same pattern showing a decrease of the p-values across quarters of birth of the fathers (from the first to the last quarter of the eligibility year) is again clearly observed for semiprofessional players who didn't become full professionals. What is important, however, is that now the tests of equality of distributions do reject the hypothesis of equality of distribution of quarter of births for each and every quarter of birth of fathers. The rejections are quite strong, in every case with a p-value below .001. Without having to do any statistical test, it is visually compelling to see that, relative to the population, these parents have on average about a 40% greater number of births in the first quarter of the eligibility year, ranging from 24.5% if the father was born in the first quarter of his eligibility year to 69% if the father was born in the last quarter. For a given quarter of birth of the father, I also find a steady decline in the relative number of births per quarter as we move from the first quarter after the cutoff date to the last quarter of eligibility. This pattern holds for all parents, regardless of their own quarter of birth.
iv. Finally, for amateur players that made it up to the regional leagues, similar patterns are found as in *La Liga2*, though in no case are the tests significant at conventional levels.

Thus the extent to which soccer players have children at times of the year that are different from those for the general population is clearly observed in the raw data. This can also be studied and confirmed using a probit framework or similar regression specifications. For instance, table 3 reports the results of the specification

$$Q1_{it} = \Phi\left\{\alpha + \sum_{h=2}^{H}\gamma_h \times F_{it}^h + \delta_t + \mathbf{X}_i\right\}$$

in the AFE dataset (which does not include amateur players), where $Q1_{it}$ equals 1 if the child of father i was born in year t in the first 3 months after the cutoff date, and 0 otherwise, and F_{it}^h equals 1 if the father i of the child born in year t has characteristic h, and 0 otherwise. The term δ_t represents year fixed effects, and $\mathbf{X}_i$ represents regional effects (child) and controls for nationality (father). I consider two separate specifications. In the top half of table 3, h refers to the quarter of birth of fathers who played soccer, $h = 1, \ldots, 4$. In the bottom half of table 3, h refers to the highest division level the father played in, with $h = 1, 2, 3$ for *La Liga*, *La Liga2*, and the

TABLE 3

Heterogeneous Responses by Father Characteristics

Characteristic	Specification Results
Quarter of birth of soccer fathers:	
Constant	−.780***
	(.101)
Father born in Q2	.036
	(.032)
Father born in Q3	.099***
	(.033)
Father born in Q4	.246***
	(.036)
Regional fixed effects	Yes
Year fixed effects	Yes
Nationality fixed effects	Yes
Log likelihood	−7,168.9
Pseudo R^2	.0035
Division level of soccer fathers:	
Constant	−.870***
	(.103)
Father professional *La Liga2*	.012
	(.040)
Father semiprofessional	.273***
	(.034)
Regional fixed effects	Yes
Year fixed effects	Yes
Nationality fixed effects	Yes
Log likelihood	−7,138.4
Pseudo R^2	.0124

Source.—AFE dataset ($N = 11{,}600$).

Note.—Q2, Q3, and Q4 represent the second, third, and fourth quarters after the cutoff date. Standard errors appear in parentheses.

*** Statistically significant at the 1% level.

semiprofessional divisions, respectively. In these specifications, fathers with $h = 1$ are the default.

The results are consistent with the evidence from the raw data: certain parents appear to target birth dates to ensure that their children are among the oldest (and therefore physically stronger and more mature) children in their eligibility year. The size and significance of the estimates show a tendency consistent with the distribution of children's births getting increasingly skewed toward the first quarter as fathers are born further away from it. Similarly, the tendency gets stronger as we move toward fathers in the lower ranges of professionalism, who arguably "almost made it," being insignificant for the top levels of professionalism.[16]

C. *Causality: Response to an Exogenous Change in the Cutoff Date for Eligibility*

The evidence presented so far suggests that certain parents respond to the opportunities that relative age effects provide by timing the births of their children. It is conceivable, however, that other effects may contribute to a partial or even full explanation of these results. For example, soccer players may perhaps tend to come from specific backgrounds, may have specific socioeconomic characteristics, or may tend to marry women from certain education and socioeconomic backgrounds. Across the different levels of professionalism, there may be other relevant variations in backgrounds, characteristics, and marriage patterns. Season of birth effects could also be related to season of work in this occupation, which is typically from September to June, in nontrivial ways.

To address this issue and provide a sterner test of the hypothesis that subjects respond to the incentives provided by relative age effects, I take advantage of an exogenous change in the cutoff date in 1995. Prior to 1995, the RFEF allocated youth players into chronological age groups on the basis of an August 1 cutoff date. This was the same date used by the world-governing body of soccer, FIFA, in all the youth international competitions that it regulates, including World Youth Championships and the Olympic Football Tournament. In 1995, however, FIFA changed its age regulations. It announced that right after the U20 World Championship in Nigeria (March 11–26, 1995), the selection year for international competitions would be changed to correspond with the calendar year, that is, starting on January 1 and ending on December 31.[17] Because

[16] Needless to say, not every parent that targets a birth date needs to be successful, and some such parents may have "missed" their goal by a few days. The dataset includes 51 children of semiprofessional fathers born a little too early (within 1 week before the cutoff date). Of course, this may include parents that had a goal and missed it and parents that did not have a goal. In most cases (40), it is their first child. Notably, although the sample size is small, they appear to be more likely than average to have subsequent children in Q1 and Q2.

[17] See FIFA Circular Letter nos. 527, 576, and 635 to the national federations. Eligibility rules for a tournament are typically issued 2 years prior to it to regulate all the qualifying

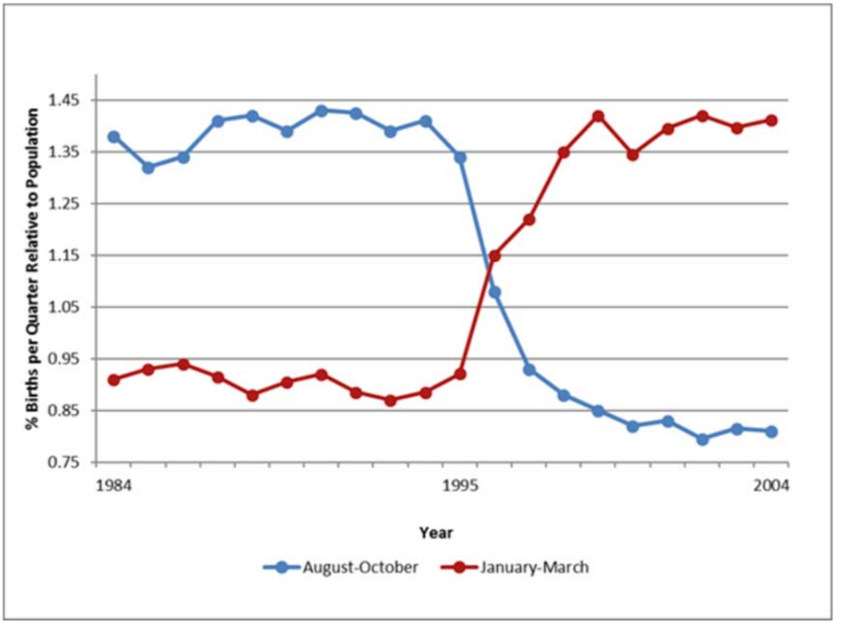

Figure 1.—Proportion of births in Q1 relative to population before and after change in cutoff date.

national federations generally align the rules of their national competitions with FIFA rules to harmonize player eligibility between national and international competitions, the RFEF altered the cutoff date from August 1 to January 1.[18]

If specific socioeconomic characteristics, backgrounds, marriage patterns, season of work, and other reasons are partially or fully responsible for the birth-date patterns that are observed, there should be little or no change in the distribution of births before and after 1995. However, if players react to the incentives that relative age effects provide, we should find that players right in 1995 or soon thereafter will tend to change the quarter of birth of their children. Figures 1 and 2 report the basic evidence for soccer players and for the population at large for a 10-year window before and after 1995 simply by breaking out the data by year of birth.

The results are quite clear and consistent with the idea that subjects respond to the opportunities provided by relative age effects. Subjects react to the change in cutoff dates and soon after the cutoff change come back

games and preliminary rounds. The eligibility rules for the 1995 U20 World Championship in Nigeria and for the 1995 U17 World Championship in Ecuador were the last ones based on the August 1 cutoff. The regulations for the following U17 and U20 championships, which took place in Egypt (September 4–21, 1997) and Malaysia (June 18–July 5, 1997) were publicly issued immediately after the 1995 tournaments ended.

[18] Not surprisingly, studies in both youth and senior soccer players reveal the shift in the relative age effect along with the revised cutoff date (see, e.g., Drut and Duhauotis 2014).

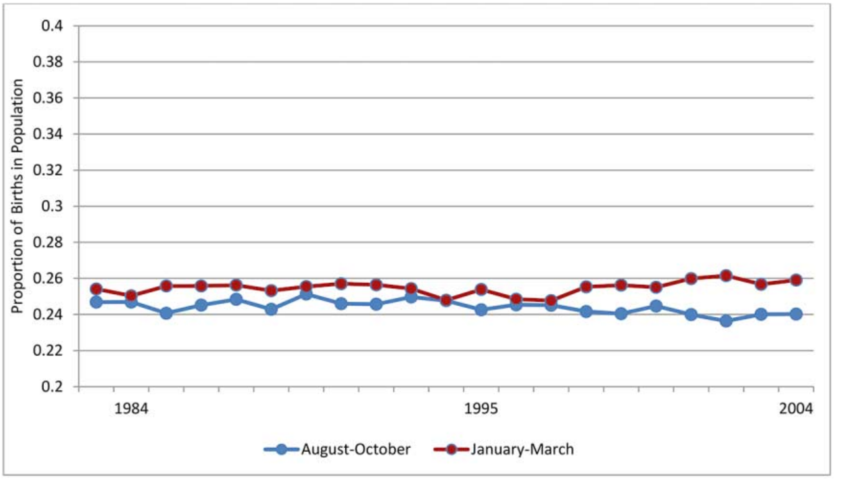

Figure 2.—Proportion of births in the population in Q1 before and after change in cutoff date.

to exhibiting a proportion of first-quarter births similar to that before 1995. At the same time, however, the proportion of births in the general population remains relatively stable, about 0.245–0.255 per quarter both for the January–March and for the August–October quarters during the whole period. Figure 1 also shows that it appears to take about 3 years for subjects to fully complete their reaction. As for the exact reasons for this delayed reaction, they likely include information, adjustment, and planning costs: it is certainly not possible to fully adjust immediately, plus there are likely delays in information and in becoming aware of the change.[19]

Needless to say, beyond reporting of the raw data, we can also study this aspect using a probit framework. For example, table 4 reports the results of the specification

$$\text{JAN–MAR}_{it} = \Phi\{\alpha + \beta \times F_{it} + \gamma \times F_{it} \times \text{POST}_{it} + \delta_t + \mathbf{X}_i\},$$

where JAN–MAR_{it} equals 1 if the child of father i was born in year t in the months of January, February, or March, and 0 otherwise; F_{it} equals 1 if the father i of the child born in year t was a soccer player, and 0 otherwise; and POST_{it} equals 1 if the year of birth is after 1995, and 0 otherwise.

The results confirm the patterns observed in the raw data: there appears to be nothing in the football calendar, marriage patterns, and other aspects that leads to higher fertility in the January–March period; it is

[19] I have not been able to find internal records showing the exact date when the change in cutoff date, once approved, was communicated to the regional federations in Spain, and then to the clubs and teams in each region and province. Team rosters are typically determined between the end of the season (around June–July), before the beginning of next season (around end of August).

TABLE 4
JANUARY–MARCH RESPONSE TO EXOGENOUS CHANGE IN CUTOFF DATE

	(1)	(2)
Constant	−.678***	−.613***
	(.012)	(.070)
Father player	−.010	−.026
	(.021)	(.025)
Father player × Post-1995	.204***	.237***
	(.024)	(.035)
Regional fixed effects	No	Yes
Year fixed effects	No	Yes
Nationality fixed effects	No	Yes
Log likelihood	−13,343.3	−13,305.3
Pseudo R^2	.0036	.0064

Sources.—AFE dataset ($N = 11{,}600$) and randomly selected sample of same size from the general population.
Note.—Standard errors appear in parentheses.
*** Statistically significant at the 1% level.

only after the change in cutoff date that fertility increases in these 3 months of the calendar year.

Finally, the two important sources of heterogeneity across father types documented in subsection IV.B can also be studied using similar specifications. For example, table 5 reports the results from

$$\text{JAN–MAR}_{it} = \Phi\left\{\alpha + \beta \times F_{it} + \sum_{h=1}^{H}\gamma_h \times F_{it}^h \times \text{POST}_{it} + \delta_t + \mathbf{X}_i\right\}.$$

Not surprisingly, the results confirm the same heterogeneity in the responses observed earlier in the raw data.[20]

These findings represent, to the best of my knowledge, the first causal evidence in the literature showing that birth timing at conception responds to intergenerational human capital incentives. In the appendix, I report survey evidence showing that the relative advantage of being older in one's cohort (and therefore being at physical advantage when performing sports activities) translates, as expected, into children participating more frequently in sports activities, and importantly that this greater participation appears to have a complementary effect with scholarly activities. Although merely descriptive, this complementarity accords well with existing research in the literature.

V. Conceptual Framework: A Model of Salient Birth-Timing Incentives

The differential responses across parents that are found in the data are interesting in their own right. More than interesting, they are perhaps

[20] The bottom half of table 5 splits F_{it} by the division level. Addition of controls for birth order either as a linear term or as indicators in the top and bottom halves of the table suggests that the experience of an older sibling may tend to make the effect stronger, albeit this is significant only at 6%–9% levels in the different specifications.

TABLE 5
Heterogeneous January–March Responses to Change in Cutoff Dates by Father Characteristics

	(1)	(2)
Quarter of birth of soccer fathers:		
Constant	−.678***	−.613***
	(.012)	(.070)
Father player	−.010	−.026
	(.021)	(.025)
Father born in Q1 × Post-1995	.131***	.164***
	(.036)	(.044)
Father born in Q2 × Post-1995	.178***	.211***
	(.036)	(.044)
Father born in Q3 × Post-1995	.229***	.261***
	(.039)	(.046)
Father born in Q4 × Post-1995	.343***	.374***
	(.045)	(.052)
Regional, nationality, year fixed effects	No	Yes
Log likelihood	−13,334.6	−13,296.8
Pseudo R^2	.0042	.0070
Division level of soccer fathers:		
Constant	−.678***	−.610***
	(.012)	(.070)
Father professional *La Liga*	.040	.027
	(.044)	(.046)
Father professional *La Liga2*	.040	.023
	(.040)	(.042)
Father semiprofessional	−.042	−.058**
	(.026)	(.028)
Father professional *La Liga* × Post-1995	.028	.059
	(.59)	(.065)
Father professional *La Liga2* × Post-1995	−.026	.003
	(.054)	(.060)
Father semiprofessional × Post-1995	.331***	.364***
	(.031)	(.040)
Regional, nationality, year fixed effects	No	Yes
Log likelihood	−13,315.9	−13,277.5
Pseudo R^2	.0056	.0085

Sources.—AFE dataset ($N = 11{,}600$) and randomly selected sample of same size from the general population.
Note.—Q1, Q2, Q3, and Q4 represent the first, second, third, and fourth quarters after the cutoff date. Standard errors appear in parentheses.
** Statistically significant at the 5% level.
*** Statistically significant at the 1% level.

even puzzling. Why are responses found for some parents and not for others? Is it because of differences in information? Or is it because of differences in beliefs? And if so, why such differences?

Before addressing these questions, I first outline the simplest possible framework that captures "relative age" as a choice variable. Although redshirting is not possible in the empirical setting just studied, I include it along with birth timing. The idea is to examine the basic similarities and differences between these two forms of manipulating a child's relative age because they both could be available in other settings such as schooling. Thus, consider a school setting with two periods of time, y_1

and y_2. We may think of y_1 as the year of birth and y_2 as the year of school enrollment. Birth-timing decisions are made before y_1, whereas redshirting decisions are made after y_1 but before y_2. Let B_{s_i} denote the birth of a child in semester s_i, $i = 1, 2$, of y_1, and let $u(B_{s_i})$ denote the corresponding parents' utility. Parents prefer that a child is born in the first semester, $u(B_{s_1}) \succ u(B_{s_2})$, and utility satisfies the standard assumptions. Assume that parents have decided to have a child in year 1. Birth timing is possible at a "planning cost" c_b, payable before y_1 starts. This may include the costs of attempting to conceive at specific times and sexual abstinence and outercourse to decrease the risk of pregnancy at others. Parents who pay c_b have their child born in s_1 with probability 1 and enjoy $u(B_{s_1}) - c_b$. Otherwise, their child is born in s_1 with an exogenously given probability p and in s_2 with probability $1 - p$. Expected utility is $pu(B_{s_1}) + (1 - p)u(B_{s_2})$. Obviously, this formulation means that a birth is guaranteed to occur in y_1. After the child is born, redshirting is possible at a cost c_r, independent of the birth semester and payable before y_2 starts. Parents who pay c_r will enjoy utility $u(B^r_{s_i}) - c_r$, with $u(B^r_{s_1}) \succ u(B^r_{s_2})$. A child born in s_i will be redshirted if and only if $c_r < u(B^r_{s_i}) - u(B_{s_i}) = \Delta^r u(B_{s_i})$. This means that depending on the magnitudes of c_r, $\Delta^r u(B_{s_1})$, and $\Delta^r u(B_{s_2})$, we may have parents that will never redshirt their child, parents who will only redshirt their child if born in one of the semesters but not in the other, or parents who will redshirt their child regardless of the semester in which the child is born. Assume, as in our empirical setting, that redshirting is not legally possible (it is mandatory that the child is enrolled according to his birth year) or is excessively costly. Then, expected-utility-maximizing parents will find it optimal to engage in birth timing if

$$u(B_{s_1}) - u(B_{s_2}) \geq \frac{c_b}{1 - p}.$$

Consistent with intuition, it is less likely that parents will resort to birth timing when costs c_b and probability p are greater. When redshirting could be optimal, new scenarios arise. By backward induction

- Parents who redshirt their child only if born in s_2 will choose birth timing if

$$u(B_{s_1}) - u(B_{s_2}) \geq \frac{c_b}{1 - p} + \Delta^r u(B_{s_2}) - c_r.$$

- Parents who redshirt their child only if born in s_1 will choose birth timing if

$$u(B_{s_1}) - u(B_{s_2}) \geq \frac{c_b}{1 - p} - \Delta^r u(B_{s_1}) + c_r.$$

- Parents who will redshirt their child regardless of the birth semester will also choose birth timing if

$$u(B_{s_1}) - u(B_{s_2}) \geq \frac{c_b}{1 - p} + \Delta^r u(B_{s_2}) - \Delta^r u(B_{s_1}).$$

Put simply, conditional on redshirting being optimal only when the child is born in s_2, birth timing is less likely to be appealing than when redshirting is not possible. When redshirting is optimal only when the child is born in s_1 (perhaps an unlikely empirical scenario), birth timing becomes more likely. When redshirting costs are such that it is always optimal, the impact on the likelihood of birth timing depends on the sign of $\Delta^r u(B_{s_2}) - \Delta^r u(B_{s_1})$. Consistent with intuition, the distribution of redshirted children is skewed toward those born later in the year in different datasets (see, e.g., Graue and DiPerna 2000; Aliprantis 2012), which suggests that redshirting may be particularly profitable when a child is born in s_2.

Within this general framework, many extensions are readily possible. For instance, birth timing may be successful with probability less than 1, the probability that a baby is born in y_1 may be less than 1, temporal discounting may play a role, or new information might arise after the child is born but before he is to be enrolled in school. A less trivial extension is that only some parents may be "aware" that birth timing is a possibility. This is relevant in our setting because it may explain the heterogeneous responses found in the data. Why this heterogeneity?

A first potential mechanism to consider is differential access to information. This would require that only those negatively affected by cutoff date, and among these only semiprofessional subjects that were at the margin between "success" (professionalism) and "failure" (amateurism), know about the cutoff dates and their consequences. This hypothesis, however, does not seem very persuasive for at least two reasons. First, information is publicly available to everyone, not only to those born in the later part of the eligibility year, and is clearly independent of outcomes. Second, costless information sharing and within-group experiences (teammates over many years) essentially guarantee complete information to everyone.[21] Similarly, an explanation based on differential costs of birth timing c_b or probability p by subject types (talent level and birth date) does not seem persuasive for obvious reasons.

A more intuitive potential explanation is found in the recent literature on salience, memory, and decision-making. Bordalo, Gennaioli, and Shleifer (2012, 2013) propose a new psychologically founded model of choice under risk and for riskless choice, respectively, in which attitudes are driven by the salience of payoffs. They follow Taylor and Thompson's (1982) definition: "salience refers to the phenomenon that when one's attention is differentially directed to one portion of the environment rather than to others, and the information contained in that portion will receive disproportionate weighting in subsequent judgments." Payoffs that draw the decision-maker's attention are "salient." The idea is that

[21] Soccer is a team sport, and every participant must have had several friends and teammates year after year throughout his career that had to move to a higher age category because of their birth dates, while others, just a few days or weeks younger, were allowed to stay in the same age category one more year.

decision-makers do not take into account fully all the information available to them but overemphasize the information that their minds focus on. Gennaioli and Shleifer (2010) call such decision-makers "local thinkers," because these decision-makers neglect potentially important data. Their theory provides a tractable framework for a psychological mechanism based on ex post attention allocation to salient features of the environment. It generates context effects and provides a unified account on many empirical phenomena, including a variety of field and lab disparate evidence that is very difficult to account for in standard models. This includes risk-seeking behavior, the Allais paradox, preference reversals, decoy effects, context-dependent willingness to pay, and others.

A key contribution of the study by Bordalo, Gennaioli, and Shleifer (2020) is that it also incorporates the model of memory from Kahana (2012) into their salience theory of attention and choice, where events are encoded as "memory traces," and similarity-based recall implies that personal history frames subjects' attitudes across the experiences that come to mind. Current experiences activate past experiences in the memory database to different degrees of activation.[22] Bordalo et al. (2019) quote Deaux and Farris (1977), who indicate

> Performances which are consistent with an expected level of performance will be attributed to stable factors and, in the case of an individual performance, ability is the most frequent choice (either the presence of ability in the case of expected success or a lack of ability in the case of expected failure).

Talent or ability, therefore, is salient both in the cases in which success is clear and in the cases when failure is clear. As for other cases, that is, when success versus failure is "marginal," they contend that

> Performance, in contrast, is more likely to be explained by some factor such as luck.

I argue below that this process of causal attribution is consistent with what is observed in the data, in particular with a simple form of persistent misattribution and a standard salience function.[23] Indeed, Bordalo, Gennaioli, and Shleifer (2020) can readily accommodate the possibility that certain events may leave stronger traces in memory and thus can more easily be retrieved by assuming that activation of a past experience increases with the distance between the current experience or decision and the "norm" that is evoked in the database. So, I build on this literature not by providing a new theory but by providing empirical causal results that are consistent with the prediction of this framework in a novel setting.

[22] See also Moore and Healy (2008) on aspects shaping belief distortions and overconfidence.
[23] See also Gagnon-Bartsch, Rabin, and Schwartzstein (2021) for a model showing how misspecified models may rationally persist.

Consider these ingredients:

- Own talent is invoked both when performance is high (professionalism) and when it is low (amateur). Luck is invoked when performance is "marginal" (semiprofessionalism).
- The talent of a child cannot be chosen.
- Consistent with misspecified models and attribution effects, the "norm" that is activated for marginal performances is a birth date early in the eligibility year; that is, it is perceived "more normal" not to be punished by the bad luck of a birth date (i.e., it is more unusual to be punished). This accords well with well-known mechanisms in social psychology that report cognitive biases and tendencies known as attribution errors or biases. The "defensive attribution hypothesis" is a behavioral tendency to attribute greater blame than warranted to a harm-doer (a "bad" birth date when one "almost" made it to the professional level). The "self-serving bias" is similarly defined as a tendency to claim more responsibility for successes than for failures: successes are claimed "internally" whereas failures are claimed "externally."[24]
- There is a cost of birth timing $c_b > 0$, and redshirting is not possible.
- Finally, with respect to the salience function $f(x, x^n)$ of attribute x (birth date), where x^n denotes the normal level, it is fine to consider the symmetric and continuous function that satisfies the ordering and diminishing sensitivity conditions already postulated in Bordalo, Gennaioli, and Shleifer (2012, 2013), and which Hastings and Shapiro (2013) use in empirical work:

$$f(x, x^n) = \frac{|x - x^n|}{|x| + |x^n|},$$

  where x^n represents a birth date "early" in the eligibility year. When this function is normalized by the level of talent recalled as the cause of performance, it looks like a half-bivariate Gaussian curve shown in figure 3: (i) limited or no attention is given to one's birth date when talent is very high or very low (only talent is invoked); (ii) for marginal performances (when there is only the bad experience of not making it to professionalism), one's date of birth becomes more salient as we approach the end of the eligibility year.

Summing up, recall of past conditions and causal attributions driven by salient factors shape the inputs of parents' decisions. Here, the decision problem itself (having children) acts as a cue to retrieve related information. For some this brings to mind issues related to birth timing, but for others it does not. The former are the people for whom birth timing was at the front of their minds growing up. These people are overrepresented among those who ended up being semiprofessionals, because in their

[24] See Zuckerman (1979), Forsyth (2008), and references therein for a discussion of these biases.

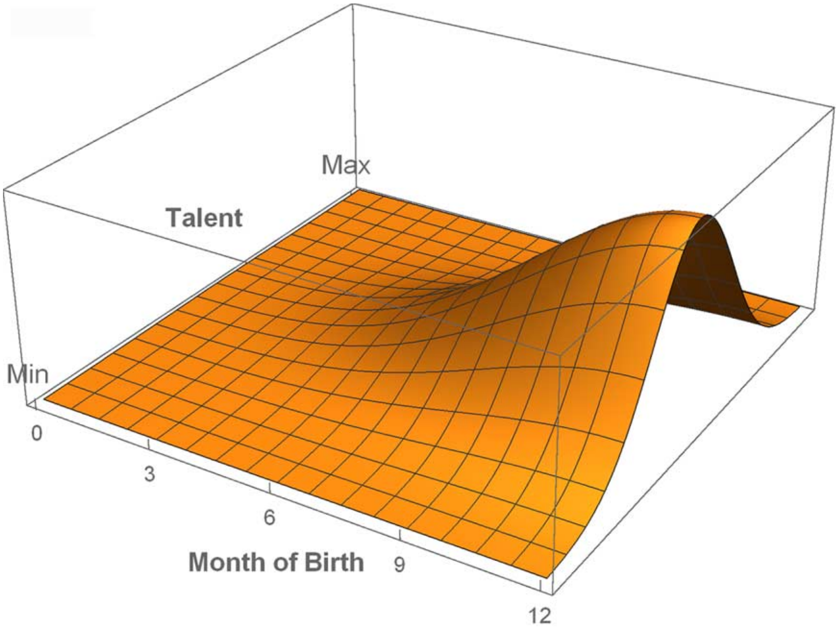

Figure 3.—Salience-weighting function.

experience birth timing turned out to play a big role in the binary outcome of becoming semiprofessional as opposed to professional. This captures an interesting interaction between experience, institutional details, and beliefs. Further, it is sufficient but not strictly necessary to invoke thinking about talent (rather, we can just invoke how much thought is given to birth timing). From this perspective, it is an example of an "experience effect," as in Malmendier and Nagel's (2011) depression babies (those who experienced bad returns on the stock market are more pessimistic about its future performance and less likely to invest at any time).[25]

Finally, in order to substantiate this conceptual framework, I have implemented a survey (see the online app., part B) on all the players listed in the AFE dataset. The survey asks about their "coding" of relative age effects, recollection of these effects, and incentives at the time they were planning to have children. The results are presented in table 6.

As may be seen, the answers exhibit a pattern similar to the shape of the salience-weighting function. Hence, although merely descriptive, these responses can be taken as prima facie evidence consistent with a memory-based theory of salience. Note also that there is a role for coding in this setting as most, but not all, subjects knew about and coded relative age effects. Future theoretical work may also enrich the theory by allowing the possibility that a decision-maker may not notice, not encode, or encode separately certain attributes (see Schwartzstein 2014; Bushong and

[25] I am grateful to Pedro Bordalo for this insight and for useful discussions of this aspect.

TABLE 6
SURVEY FREQUENCIES OF CODING RELATIVE AGE EFFECTS, RECALLING RELATIVE AGE EFFECTS, AND BIRTH-TIME PLANNING

	Birth Quarter 1	Birth Quarter 2	Birth Quarter 3	Birth Quarter 4
	Coding Relative Age Effects			
La Liga	10	11	11	12
La Liga2	10	10	11	12
Semiprofessionals	10	10	12	12
Top amateurs	10	10	11	12
Other amateurs	10	11	12	12
	Recalling Relative Age Effects			
La Liga	2	2	3	4
La Liga2	3	4	5	6
Semiprofessionals	6	8	10	11
Top amateurs	4	5	6	7
Other amateurs	2	2	3	4
	Reacting to Relative Age Effects			
La Liga	1	1	2	3
La Liga2	2	3	4	5
Semiprofessionals	5	7	9	11
Top amateurs	3	4	5	6
Other amateurs	1	1	2	3

Note.—Top amateurs are subjects who were teammates with semiprofessionals. The numbers in each level–birth quarter combination correspond to the percentages of subjects in the full sample who answered "Yes" to question nos. 1, 2, and 3 in survey B (see the online app., part B): 1, <1%; 2, 1%–5%; 3, 6%–10%; 4, 10%–20%; 5, 20%–30%; 6, 30%–40%; 7, 40%–50%; 8, 50%–60%; 9, 60%–70%; 10, 70%–80%; 11, 80%–90%; 12, 90%–100%.

Gagnon-Bartsch 2022). Finally, memory need not be the only mechanism driving observed behavior. People may also care about self-image, with larger self-delusions being costlier, and self-image may interact in subtle ways with selective memory and experience. Future research may try to tell other specific mechanisms apart.

VI. Concluding Remarks

Economic success and failure run in the family, and nongenetic noncognitive aspects of behavior are often central to this process. Parents make some of the important choices that influence the economic success of their children, and parental priorities translate into economic outcomes for children. I have taken advantage of a unique setting to study an important choice that parents may make: the birth date of their children. As a response to relative age effects, certain parents with previous personal exposure to and specific experiences with these effects respond to the opportunities that these effects provide. Their responses involve a margin that, to the best of my knowledge, has not previously been documented: use of birth timing at the time of conception as an instrument for specific human capital transmission and enhanced opportunities.

The setting affords useful insights because of a combination of important advantages: observability of skill levels, a rich dataset, high incentives, and an exogenous variation in the date for eligibility. I take the main contributions to be the following.

First, while the evidence is consistent with the general principle that agents respond to incentives widely applied with great success in all fields of economics, the specific incentives examined here (grounded in relative age effects) have not been studied before in the labor economics literature and the economics of the family.

Second, the results represent, to the best of my knowledge, the first causal evidence in the literature showing that birth timing at conception responds to incentives.

Third, the heterogeneity in the responses to incentives points toward a memory-based salience theory of attention and choice. As such, it appears to be the first time that the salience literature is related to the literature on the economics of the family and human capital.

Fourth, the evidence contributes to the empirical literature on parental human capital mediation, birth-date manipulations, early-childhood circumstances, and nonaccidental interventions by providing evidence from a distinct aspect or characteristic in each area.

In terms of future research, the specific situation I have studied is ideal in many dimensions. The setting is highly competitive and concerns the world's most popular sport and one of the preeminent leagues in the world. Monetary and nonmonetary incentives are high from youth to professional levels, and parents participated previously in the same setting with the opportunity to gain highly specific knowledge, information, and experiences. Also, no redshirting is possible. These virtues testify to the unique advantages that are sometimes found in sports settings to conduct empirical work and uncover new phenomena (Palacios-Huerta 2014, 2023). As Simon (1999) emphasizes (italics added),

> One is struck by [the fact that we] have been preoccupied almost exclusively during the past half-century with verification and falsification and have almost ignored the processes of discovery. … [Economics] needs to return to the *phenomenon-finding* and *hypothesis-finding* component of science, not limiting itself to hypothesis-testing in experiments. . . . You only need a setting that is likely to produce some new patterns, and you must watch for them.

Future research should study less ideal settings, including other leagues, countries, and sports where relative age effects are weaker, where the economic and social returns to participate may not be as high, or with cultural differences in the tendency to exhibit self-serving and other attribution biases.[26] It would also be important to study settings where physical development

[26] Examples include countries with fewer highly qualified coaches per capita, with lower social and economic incentives, and with less popular attention to this occupation.

does not play a role, only cognitive and emotional maturity advantages, but where incentives are still very salient. For example, does repeated exposure to relative age effects induce similar birth timing in kindergarten teachers and other schoolteachers when they decide to have children? Are incentives salient enough to induce similar responses? When do these incentives matter if redshirting is possible?

Finally, in terms of generalizability, the results in this specific setting suggest that memory-based salience may play an important role in the economics of the family. The fact that salience theory predicts what is observed empirically and confirmed by survey evidence means that salient incentives can be emphasized at least as suggestive of similar forces operating in a range of contexts involving long-term planning, family, and human capital investments. Finding new sources of childhood stimulation and complementarities with future skill formation is indeed quite important for education and social policy directed toward promoting the malleable early years.

Appendix

Survey Evidence on the Consequences for Children in Terms of Sports and Scholarly Activities

To explore the consequences that birth timing may have for children, I report the results of a survey conducted on the same subjects studied in the AFE dataset. I obtained 1,717 responses of fathers, who had a total of 2,597 children. This survey, available in the online appendix (part A), asks about children's participation in official organized soccer requiring youth-club-player registration (typically beginning as early as age 6) and school performance at the end of preschool (age 6), primary school (age 12), and secondary or middle school (age 16). It also asks about performance in the national standardized scholastic-achievement test required to enter college and called Selectividad (at age 18).[27] Response rates are uncorrelated with month of birth of father and children, and other characteristics.

Official soccer participation.—Figure A1 reports participation in official organized soccer requiring a club-player registration form (*ficha*).

Research in social psychology has also found interesting cultural differences in the tendency to exhibit self-serving and other attribution biases across countries.

[27] See https://en.wikipedia.org/wiki/Selectividad.

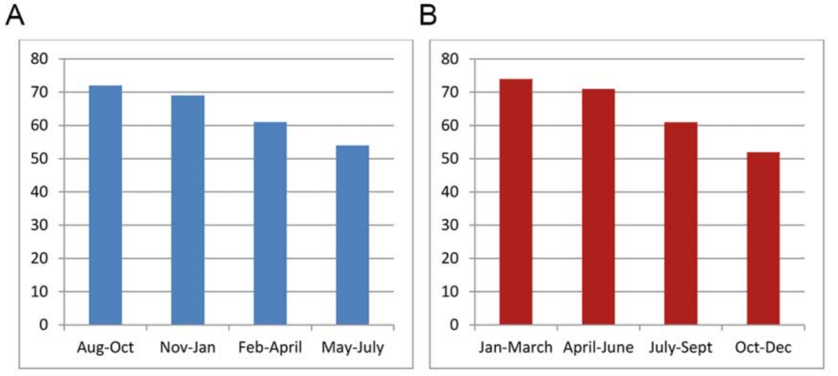

Figure A1.—Participation in official federation soccer by quarter of birth: *A*, 1976–95; *B*, 1996–2015. Percentage of male children who have had, at least once, an official license to play federated soccer registered in a regional federation member of the RFEF.

As expected, children born in the early part of the eligibility year benefit in terms of participation both before and after the 1995 change in cutoff date. Notably, it also appears that participation in the first quarter after the cutoff date, relative to later quarters of eligibility, is greater after 1995 (fig. A1*B*) than before 1995 (fig. A1*A*), suggesting that physical maturity advantages may complement the cognitive and emotional maturity advantages that are important in schooling.

Schooling performance.—The new cutoff date after 1995 (January 1) coincides with the cutoff date for school eligibility, which in Spain has remained unchanged for at least the past five decades. Because the schooling literature documents how early relative maturity effects can have long-lasting effects on student performance (see Bedard and Dhuey 2006 and others), it can then be expected that the birth-date targeting may have a number of (possibly unintended) benefits after 1995. I study this issue in figure A2.

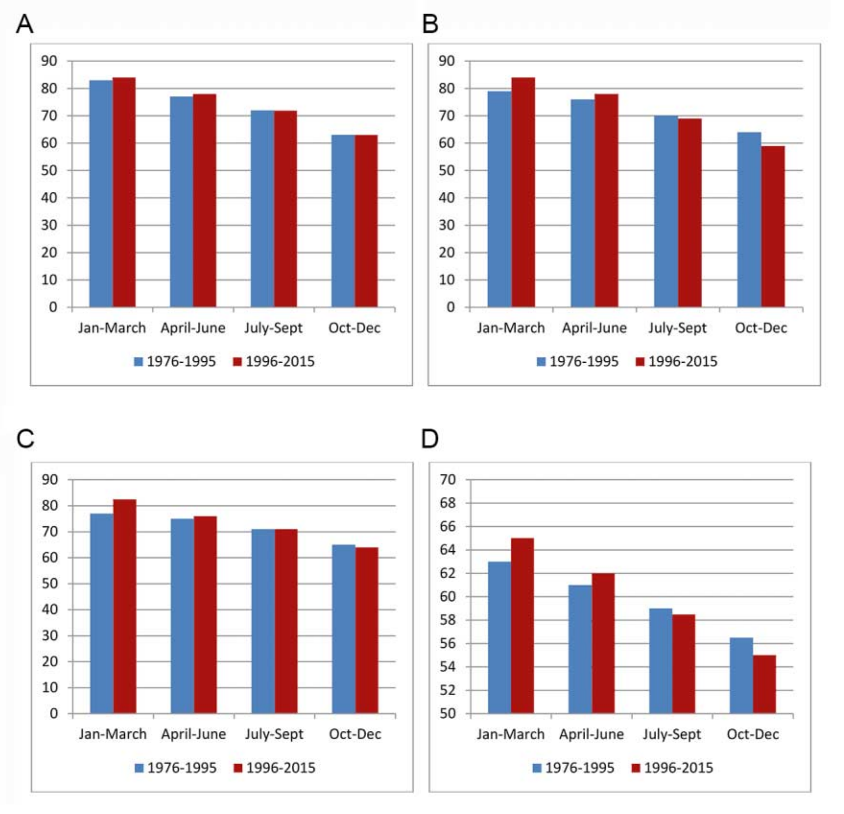

Figure A2.—School performance at the end of preschool (age 6; *A*), primary school (age 12; *B*), middle school (age 16; *C*), and in the national college-entrance test Selectividad (age 18; *D*). *A*–*C* report the unconditional average GPA (0–100) per quarter of birth; *D* reports the unconditional average score (normalized 0–100) in the test per quarter of birth.

Consistent with the schooling and human capital literature, even in these crude survey data, children born in the early part of the calendar year appear to benefit in terms of school performance in preschool, primary school, and middle school. They also score higher on the national achievement test required to enter college. These benefits appear to be relatively greater after 1995 than before the change in cutoff date. Standard Kolmogorov-Smirnov tests of stochastic dominance, for example, show that the 1996–2015 distributions dominate the 1976–95 distributions at the quarterly and monthly (not shown) frequencies for the three age levels (6, 12, and 16) and also for the Selectividad score at significance levels beyond the .01 level. Consistent with an important literature, this suggests physical maturity advantages may complement the cognitive and emotional maturity advantages that are particularly important in human capital environments.

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