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How are they doing? The academic performance and mental wellbeing of world cup babies

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ABSTRACT

In June 2002, South Korea cohosted the 17th FIFA World Cup. Unexpected wins carried the Korean National Football Team to the semi-finals and sparked an unprecedented euphoria among Koreans. Die-hard fans and occasional football viewers, young and old, women and men flocked the streets side by side, cheered for their team, and partied through the nights. In the subsequent spring of 2003, the country experienced a temporary and significant increase in its fertility rate. Using a difference-in-differences design, we exploit the quasi-experimental nature of this episode to investigate the Beckerian trade-off between the quantity and quality of children born to parents in South Korea. Our results support the notion of an adverse effect on child quality. Students born approximately ten months after the World Cup tend to perform significantly worse in school. Moreover, our results uncover a hitherto overlooked aspect: the same students exhibit significantly higher degrees of mental wellbeing.

1. Introduction

In 2002 between the 31st of May and the 30th of June, South Korea and Japan jointly hosted the 17th FIFA World Cup. Although FIFA ranked the Korean National Football Team only 43rd in its 2001 edition of the men's world ranking, the team accelerated to the semi-finals.[1] The unexpected match results made Korean people gather in large numbers on the streets and in stadiums to cheer for their national team as shown in Fig. 1. Conservative media viewed the excessive joy and general euphoria with skepticism. The main fear was that there could be adverse effects on labor productivity, public security, and mental health issues caused by the prolonged cheering events and mass gatherings (Dong-A Ilbo, 2002a; Dong-A Ilbo, 2002b; Yonhap News Agency, 2002). In the aftermath, some newspapers showed additional concerns due to the unexpected increase of pregnancies (Seoul Broadcasting Service, 2003; Four Dangerous Outcomes of the 'World Cup Baby Boom; Seoul Broadcasting Service, 2010; The Korea Economic Daily, 2014).

In fact, South Korea experienced a temporary increase in the total fertility rate[3] the year following the 2002 FIFA World Cup. Although the total fertility rate had continuously decreased since the 1990s, the rate exceptionally increased in 2003 as shown in Fig. 2 (Statistics Korea, 2006).

As can be seen, the total fertility rate was 1.17 in 2002; then rose to 1.19 in 2003 before it fell back to 1.16 in 2004. In particular, the ratio of babies born in spring (roughly ten months after the June 2002 World Cup) relative to the January borns increased sharply in 2003.[4] Table 1 shows the ratios of March, April, and May borns compared to the January borns.

As the above table shows, the March/January ratio increased by 2∼3

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[1] The South Korean national team played their first game on June 4th and won against Poland. On June 29th, the South Korean team was defeated by Turkey in the third place play-off.

[2] Credit: Ministry of Culture, Sports, and Tourism (2017).

[3] The total fertility rate (TFR) in South Korea is calculated as follows: TFR = ∑(ASFR)/1000 where ASFR refers to the age-specific fertility rate (Statistics Korea, 2023) and the summation extends over all age groups.

[4] Because Korean schools officially start in early March, Korean parents wish to give birth in January or February to ensure that their children are relatively old at school based on the (false) belief in a relative age effect (Bethmann & Cho, 2021). As a result, January usually has the largest number of newly born babies compared to other months. For this reason, we use the number of January born children as a reference when reporting the births increases in the March, April and May of 2003 (cf. Table 1).

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List of abbreviations:

DID	difference in differences
KCYPS	Korean Children and Youth Panel Survey
NYPI	National Youth Policy Institute
OLS	ordinary least squares

Fig. 1. Mass gathering in Seoul 2002.[2]

percentage points compared to 2002 and 2004. Similarly, the April/January ratio increased by 6 percentage points and the May/January ratio increased by 5~6 percentage points compared to 2002 and 2004. Several statistical tests indicate that the temporary increase in the spring of 2003 was indeed significant (see Table A1 in the appendix).

The primary goal of this paper is to use the 2002 World Cup induced upward blip in the Korean fertility rate as an experiment to check whether a quantity-quality trade-off in reproduction exists and how it affects the wellbeing of children born during this episode. From the standpoint of economic theory, the event with its overwhelming excitement and joy temporarily lowered the costs of pursuing a quantity-oriented reproductive strategy. For about one month rollicking parties distracted the Korean population from the worries of everyday life and anxieties about the future, which ultimately affected the fertility rate. Important for statistical identification, the way the event was received and celebrated by the Korean public was unforeseen. The Korean government, in particular, did not intend to affect fertility rates when it decided to host the 2002 World Cup. Even in hindsight, the whole episode seems unlikely considering the history of poor performances of the Korean National Football Team at tournaments preceding the 2002 World Cup.

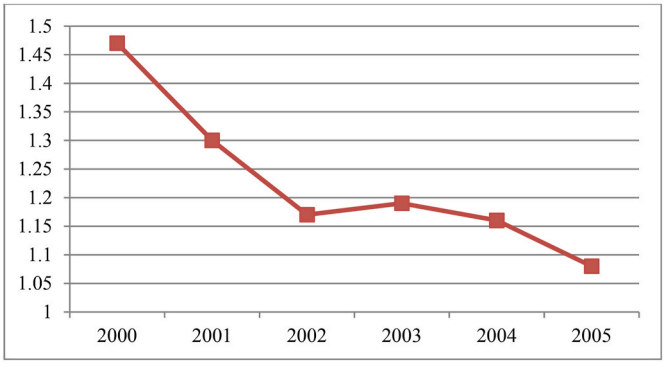

Fig. 2. Total fertility rate of South Korea.

The exogenous fertility shock may have affected Korean couples in diverse ways. Couples with pre-born children, for example, had a higher chance of conceiving an additional child thereby lowering human capital investments per child. Similarly, childless couples had higher chances of having an unexpected pregnancy that typically results in subpar parental investments (Cavalcanti, Kocharkov, & Santos, 2020; Gipson, Koenig, & Hindin, 2008; Marston & Cleland, 2003). Although the two groups most likely differ with respect to average ages, marital statuses, stability and durations of the relationships, they may both share comparatively low parental expectations with respect to the academic performance of their newly conceived offspring. We investigate whether this hypothesis is indeed true by using academic performance (school test scores) as a measure of child quality and examine whether children born in the spring of 2003 ("World Cup children") do underperform. Our regression results show that World Cup children tend to perform worse at school (using test scores in five major subject areas) but they also show higher degrees of mental wellbeing (showing less aggressive or depressive symptoms) than children born in different years and months.

2. Background

A growing body of literature shows that seemingly irrelevant events affect the decisions of agents. The weather and seasonal changes, for example, are shown to influence people's emotions and/or moods (Denissen, Butalid, Penke, & van Aken, 2008; Sanders & Brizzolara, 1982). The induced changes of emotions and moods, in turn, affect individual decision making (Alengoz, Castellani, & Squazzoni, 2017; Schwarz & Clore, 1983).

Several studies have a more specific focus on sports activities affecting people's decision process, especially in light of crime (Kalist & Lee, 2016; Munyo & Rossi, 2013; Rees & Schnepel, 2009) and domestic violence (Card & Dahl, 2011). Munyo and Rossi (2013) show that the frustration after a surprising loss in a soccer game leads to an increase in criminal activities (and the opposite effect after a surprising win). In general, growing evidence suggests that crime rates increase during and after professional sports events (Rees & Schnepel, 2009, for college football; Kalist & Lee, 2016, for the National Football League). Similarly, Card and Dahl (2011) show that domestic violence increased on Sundays during the professional football season in the US due to frustration after disappointing match results.

Some papers have checked whether major (professional) sports events have an effect on fertility. Montesinos et al. (2013) attribute the spike in the Catalan fertility rate approximately nine to ten months after the 2009 season of the UEFA Champions League to the spectacular win of FC Barcelona against Chelsea FC at the semifinal. Similarly, Bernardi and Cozzani (2021) find that unexpected losses of local teams lead to a small decrease in the number of births approximately nine to ten months later. They claim that unexpected losses have a greater effect on fertility than expected losses. Hayward and Rybińska (2017), in contrast, show that the United States has not experienced an increase in the fertility rate

Table 1
Ratio of spring borns compared to the January borns by years.

Year	2000	2001	2002	2003	2004	2005
March borns / January borns	0.97	0.96	0.98	1.01	0.99	0.99
April borns / January borns	0.86	0.85	0.89	0.95	0.89	0.89
May borns / January borns	0.85	0.82	0.86	0.91	0.85	0.87

Note: The number of monthly new borns by year is provided by Statistics Korea (2021).

Table 2
Data structure.

Dependent Variables	Grade	First Grade Cohort (Born in 2003)	Fourth Grade Cohort (Born in 2000)
Academic Outcomes	7th Grade	7th Wave (surveyed in 2016)	4th Wave (surveyed in 2013)
Mental Wellbeing	6th Grade	6th Wave (surveyed in 2015)	3rd Wave (surveyed in 2012)

Note: The two cohorts that make up the first and fourth graders progressed to the sixth grade in 2015 and 2012 (advancing to the seventh grade in 2016 and 2013). Hence, we employ KCYPS data collected during the years 2012, 2013, 2015, and 2016, which corresponds to the 3rd, 4th, 6th, and 7th waves.

Table 3
Research design.

Control/Treatment	Born in 2000	Born in 2003	Note
Mar, Apr, May	Control	Treated	The dummy variable 'treated months' denotes March, April, and May borns.
Other Birth Months	Control	Control	

after the Super Bowl.

Despite the possible connections between major sports events and changes in fertility, no study is using the exogenous fertility shock originating from a major sports event to investigate the possible quantity-quality trade-off of children suggested by Becker (1960, pp. 209–240). The theory postulates a negative relationship between a family's number of children (quantity) and their outcomes (quality) (Becker & Lewis, 1973; Becker & Tomes, 1976). The latter dimension is typically proxied by educational achievements (Conley & Glauber, 2006; Glick, Marini, & Sahn, 2007; Lee, 2007; Rosenzweig & Zhang, 2009) or health outcomes of children (Angrist, Lavy, & Schlosser, 2010; Glick et al., 2007; Millimet & Wang, 2011). Most of the empirical work relies on siblings and twins as the main source of variations to measure the quantity-quality effects on children (see, for example, Black et al., 2005).

The statistical identification of the quantity-quality trade-off may well be at risk if the blip in Korean fertility was mainly driven by families that tend to produce less educated and/or less healthy offspring. Young, poor, and/or unmarried mothers, in particular, could distort results (Blau, 1999; Case & Katz, 1991, p. 3705; Ermisch & Francesconi, 2001; Feinstein & Symons, 1999; Finer & Zolna, 2014; Font-Ribera, Pérez, Salvador, & Borrell, 2007; Henshaw, 1998; Maani & Kalb, 2007; Shields & Hanneke, 2008). Such a selection bias could also stem from different maternal attitudes towards risky behavior. A greater tendency to consume alcohol during pregnancy, for example, is shown to harm children's performance in school and also to adversely affect (mental) health measures (Nilsson, 2017; O'Connor et al., 2002; O'Connor & Paley, 2009). Smoking is another example of such risky parental behavior (Ekblad, Gissler, Lehtonen, & Korkeila, 2010; Nigg & Breslau, 2007; Rahu, Rahu, Pullmann, & Allik, 2010). Finally, children from less supportive, cold, and neglectful parents are more likely to exhibit mental health disorders (Repetti, Taylor, & Seeman, 2002).

Our paper contributes to the existing literature by examining not only the fertility increase caused by the 2002 World Cup but also analyzing the effect this event had on the quality of children born approximately ten months after the World Cup season. Unlike the UEFA Champions League Final or the NFL Super Bowl, World Cup matches are played within the boundary of the hosting country for about one month: compared to the one-evening Champions League Final and Super Bowl events, the World Cup season is hence much longer.[5] Moreover, the boisterous sentiment during the 2002 World Cup gave ample opportunities for South Koreans to indulge in the joys of the moment. Not surprisingly, the effect of the 2002 World Cup on the South Korean fertility rate was stronger than comparable effects of the UEFA Champions League Final in Europe or the Super Bowl in the US. Fig. 2 and Table 1 both show the resulting blip in Korean fertility.

Although several papers focus on the fertility increase after major sports events (Montesinos et al., 2013; Hayward & Rybińska, 2017; Bernardi & Cozzani, 2021), there have been no studies examining the possible quantity-quality trade-off of children using the increased fertility rate caused by major sports events. Our study therefore fills a gap in the existing literature by investigating the effect the exogenous fertility shock caused by the 2002 World Cup had on child quality outcomes in Korea.

In addition, we propose to expand the view beyond the actual trade-off between the quantity and quality of children and to add an analysis of the children's mental wellbeing. The existing literature mainly focuses on the human capital formation of children from the parents' perspective using measures of academic achievements (Conley & Glauber, 2006; Glick et al., 2007; Lee, 2007; Rosenzweig & Zhang, 2009) or physical health (Angrist et al., 2010; Glick et al., 2007; Millimet & Wang, 2011). By using student mental wellbeing as the dependent variable, our paper addresses the quality dimension also from the children's perspective. Several indicators of aggressive and depressive symptoms are used to complete the picture of how World Cup children fared.

3. Data and methodology

Our study uses the first grade cohort (children born in 2003) and fourth grade cohort (children born in 2000) from the Korean Children and Youth Panel Survey (KCYPS)[6] which is conducted by the National Youth Policy Institute (NYPI) and administered by the Prime Minister's Office. The NYPI chose schools based on the size and population of South Korea's seventeen primary administrative districts. Using a proportional stratified sampling method the NYPI then randomly selected individual students. The dataset traces both the first and the fourth grade cohort from 2010 to 2016. In our analysis, we use the seventh grade for the academic and the sixth grade for the mental wellbeing outcomes as shown in Table 2.

While the survey contains detailed information about actual school test scores of seventh-graders, its fourth wave in 2013 does not provide wellbeing information of seventh grade students. Thus, we use the information from sixth-graders in our mental wellbeing analysis.

The following Table 3 summarizes our differences-in-differences (DID) research design. As can be seen, students born in the spring of 2003 constitute the treatment group in our analysis.

[5] The Korean National team played their first game on June 4th and managed to remain in the tournament until June 29th - the day the third place play-off was held.

[6] The dataset is publicly available and its detailed description can be found at https://www.nypi.re.kr/archive/board?menuId=MENU00329 [last accessed December 10, 2022].

Table 4
Descriptive statistics for academic outcome variables.

Variables	Obs	Mean (sd)	Min	Max	Description
math	3997	4.347511 (2.541759)	1	8	mathematics test score
sosci	3864	4.461957 (2.334915)	1	8	social science test score
nasci	3995	4.254568 (2.369694)	1	8	natural science test score
korean	3993	4.722014 (2.218604)	1	8	Korean language test score
english	3997	4.817113 (2.529570)	1	8	English language test score

Note: Test score is categorized as follows: 1 = 64 or less; 2 = 65 to 69; 3 = 70 to 74; 4 = 75 to 79; 5 = 80 to 84; 6 = 85 to 89; 7 = 90 to 95; 8 = 96 or above. Standard deviations are in parentheses.

In our main analysis, we used the pooled ordinary least squares (OLS) regression model to estimate the following equation (1):

$$Y_{ist}=\beta_0+\beta_1(\text{year}_t)+\beta_2(\text{treated months}_i)+\theta(\text{worldcup}_{it})+\beta_3(\text{covariates}_{ist})+\gamma(\text{school location}_s)+\varepsilon_{ist} \quad (1)$$

Note that equation (1) embodies the difference-in-differences (DID) design. The variable *year* indicates whether a student was born after the 2002 World Cup. To be precise, students born in the year 2000 (2003) are assigned zero (one).[7] The *treated months* variable identifies students born in March, April, or May. Our DID variable *worldcup* results from the interaction between *year* and *treated months*. Through this design, we can capture whether World Cup children perform worse in school tests than the control group. *Y* and *covariates* denote our dependent variable (s) and a vector of individual characteristics respectively. Fixed *school location* effects control for time-invariant observable and unobservable characteristics of school provinces (and alternatively school districts) that might influence the outcome variable. The error term is assumed to have the usual ideal properties. Finally, in addition to applying the pooled OLS regression model, we also used the fact that most outcome variables are categorical in nature and estimated equation (1) using the ordered probit regression model. Because this model is non-linear, the size of the estimated coefficient of the interaction term (worldcup_{it}) does not directly depict the magnitude of the treatment effect; its sign, however, does coincide with the sign of the treatment effect (Puhani, 2012). Thus, the ordered probit model allows us to double-check the signs of the pooled OLS regression coefficients.

Since our analysis uses two different cohorts, we also conducted several robustness checks using placebo treated months, and clustered standard errors (with clustering on the school level and on the school district level). Using alternative treated months, our placebo tests should reveal whether observations in the control group exhibit statistically significant differences in school test scores.[8] The clustered standard errors may add to the precision of the regression results. Because school characteristics (difficulty of exams, quality of teachers, and location of the school) are not changing drastically over three years, possible inconsistency issues caused by using two different cohorts maybe partially alleviated by clustering standard errors on the school level or school district level.

In our academic outcome (i.e. child quality) analysis, we use school test scores in the following five subjects as our dependent variables: mathematics (*math*), social science (*sosci*), natural science (*nasci*), *korean*, and *english*. Table 4 summarizes the learning results after pooling the two cohorts.

For our mental wellbeing analyses, we focus on the following five dependent variables: *depressed* denotes "I feel miserable and depressed"; *suicidal*, "I want to die"; *self-reproach*, "Bad things happened by me"; *bullying*, "How many times I have bullied other students"; *violent*, "How many times I have hit others (very hard)". The first three variables *depressed*, *suicidal, and self-reproach* are categorized from 1 (strong yes) to 4 (strong no). Variables *bullying* and *violent*, in contrast, are count variables. As mentioned before, we use the responses from sixth-graders as we do not have mental wellbeing information about seventh grade students. See Table 5 for a detailed definition and descriptive statistics.

The individual covariates controlled in the regressions are mother's education, log of annual household income, log of monthly allowance, students' reported physical health, having elder siblings, gender, and school districts. It is well established that family background characteristics such as parental education levels, monthly allowance, and annual household income strongly affect students' test scores (Dahl & Lochner, 2012; Davis-Kean, 2005; Duncan, Morris, & Rodrigues, 2011). As we argue below, it is advisable to control whether students are having elder siblings as their presence might interfere with our identification of any quantity-quality trade-off between children (Becker & Lewis, 1973; Booth & Kee, 2009; Hanushek, 1992; Nitsch, Faurie, & Lummaa, 2013). Moreover, gender and physical health conditions of students are controlled as they are commonly known to influence academic outcomes. Because student physical health can be endogenous to our dependent variables (especially mental wellbeing variables), we take an agnostic stand and will present regression results with and without controlling for physical health. Table 6 summarizes the descriptive statistics for the control variables.

As discussed in the introduction, previously married couples but also older couples more generally may have had a higher probability of conceiving an additional child during the World Cup. If this is indeed the case, World Cup children were more likely to have an elder sibling than students born in different years or months. As Table 7 illustrates, World Cup children (our treatment group) have a 5 percentage points higher probability of reporting an elder sibling with a one-tail p-value of 0.014.

Assuming that older mothers were already in a stable relationship,

[7] We restrict our analysis to students who entered elementary school according to their legal school age. In other words, students who were enrolled either later or earlier (i.e. not following the legal school age possibly due to mental or physical disabilities or talents) are not included. We dropped 80 students among 4221 survey participants (about 1.89 percent).

[8] The placebo tests check whether the students in the control group do or do not exhibit statistically significant differences in their academic or mental wellbeing outcomes. When conducting these tests, we drop the treated observations from the main regressions.

Table 5
Descriptive statistics for mental wellbeing variables.

Variables	Obs	Mean (sd)	Min	Max	Description
depressed	4205	3.342212 (0.769383)	1	4	I feel miserable and depressed 1 = strong yes 2 = yes 3 = no 4 = strong no
suicidal	4205	3.558859 (0.696375)	1	4	I want to die 1 = strong yes 2 = yes 3 = no 4 = strong no
self-reproach	4205	3.132461 (0.840124)	1	4	Bad things happened by me 1 = strong yes 2 = yes 3 = no 4 = strong no
bullying	4205	0.047562 (0.378567)	0	10	How many times I have bullied other students (did not report bullying = 0)
violence	4205	0.035434 (0.472286)	0	15	How many times I have hit others very hard (did not report violence = 0)

Note: Standard deviations are in parentheses.

Table 6
Descriptive statistics for control variables.

Variables	7th Grade		6th Grade		Description
	obs	mean (sd)	obs	mean (sd)	
year	4141	0.467761 (0.49902)	4205	0.475862 (0.499476)	1st grade cohort (2003 borns) = 1 4th grade cohort (2000 borns) = 0
treated months	4141	0.263946 (0.440824)	4205	0.263496 (0.440581)	March, April, and May borns = 1 others months = 0
worldcup	4141	0.123159 (0.328659)	4205	0.124851 (0.330590)	year × treated months
income	3952	4963.059 (2670.548)	4142	4835.662 (2639.491)	annual income in 10,000 KRW
moeduc	3881	2.8907 5(0.964269)	4070	2.889189 (0.971077)	mother's education
allowance	3977	3.694569 (3.87776)	4028	2.256356 (1.624053)	monthly allowance in 10,000 KRW
health	4015	1.708842 (0.562629)	4198	1.62101 (0.581673)	students' reported physical health 1 = very healthy 2 = healthy 3 = unhealthy 4 = very unhealthy
eldersibling	4141	0.505675 (0.500028)	4205	0.518668 (0.499711)	did not report elder siblings = 0 have elder siblings = 1
gender	4015	1.47995 (0.499660)	4205	1.480618 (0.499684)	male = 1 female = 2

Note: moeduc is categorized as follows: 1 = Middle School or Less; 2 = High School; 3 = Community College; 4 = University; 5 = Graduate School. Moreover, students are categorized into a total of 163 school districts in the dataset. Standard deviations are in parentheses.

Table 7
Probability of having elder siblings (unconditional mean).

	Treated Group		Control Group				
	Obs	Mean	Obs	Mean	Mean diff	t-value	P > t
Pr (eldersibling = 1)	510	0.550980 (0.022047)	3631	0.499312 (0.008299)	0.051669 (0.023635)	2.1861	0.0144

Note: Standard deviations are in parentheses.

Table 8
Probability of having elder siblings (Mother's age at birth >30).

	Treated Group		Control Group				
	Obs	Mean	Obs	Mean	Mean diff	t-value	P > t
Pr (eldersibling = 1)	222	0.711712 (0.03047)	1374	0.660844 (0.012777)	0.050868 (0.034064)	1.4933	0.0678

Note: Standard deviations are in parentheses.

Table 9
Mean difference on family traits between treated and control groups.

Family Trait	Treated Group		Control Group				
	Obs	Mean	Obs	Mean	Mean Diff	t-value	P > t
mother's age	482	30.0104	3394	29.3176	0.6928	3.7776	0.000
		(0.1602)		(0.0653)	(0.1834)		
moeduc	491	2.9165	3281	2.8817	0.0348	0.7465	0.228
		(0.0427)		(0.0168)	(0.0466)		
income	495	5407.374	3353	4894.769	512.605	3.9919	0.000
		(115.369)		(46.305)	(128.411)		
tutortime	510	114.2255	3456	118.1623	−3.9368	−0.9629	0.168
		(3.5193)		(1.4823)	(4.0887)		

Note: Standard deviations are in parentheses. Family trait moeduc refers to the mother's education level, income refers to annual household income, and tutortime refers to the average tutoring time per day.

Table 10
(OLS) DID coefficients on academic outcomes.

Variables	Statistics	Model 1	Model 2	Model 3	Model 4
math	worldcup	−0.3372*	−0.3436*	−0.3129*	−0.3202*
		(0.1871)	(0.1871)	(0.1887)	(0.1887)
	P>|t|	0.072	0.066	0.097	0.090
	observations	3516	3516	3516	3516
sosci	worldcup	−0.4762***	−0.4887***	−0.5091***	−0.5178***
		(0.1736)	(0.1736)	(0.1758)	(0.1759)
	P>|t|	0.006	0.005	0.004	0.003
	observations	3408	3408	3408	3408
nasci	worldcup	−0.5371***	−0.5516***	−0.4716***	−0.4829***
		(0.1732)	(0.1732)	(0.1749)	(0.1749)
	P>|t|	0.002	0.001	0.007	0.006
	observations	3515	3515	3515	3515
korean	worldcup	−0.3578**	−0.3627**	−0.3491**	−0.3516**
		(0.1612)	(0.1613)	(0.1627)	(0.1628)
	P>|t|	0.027	0.025	0.032	0.031
	observations	3514	3514	3514	3514
english	worldcup	−0.6126***	−0.6253***	−0.6101***	−0.6197***
		(0.1829)	(0.1828)	(0.1850)	(0.1851)
	P>|t|	0.001	0.001	0.001	0.001
	observations	3516	3516	3516	3516
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	–	–
school district fixed effect		no	no	yes	yes

Note: The table shows the estimated DID coefficients from equation (1) for the five academic outcome variables. All regressions control for year, treated months, and individual covariates as they were listed in Section III. A total of 163 school districts or 17 school provinces is also controlled in the regressions. For income and allowance, natural logarithm values are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

we conducted mean tests where we restricted our sample to students whose mothers were more than 30 years old at the time of their births. Table 8 presents the respective probabilities and the one-sided *t*-test statistic.

As can be seen, compared to Table 7 the probabilities to have an elder sibling increase by about 16 percentage points for both the treated and the control group. Consequently, the conditional *t*-test result when mothers' age at birth is greater than 30 resembles the corresponding result in Table 7. The treated group has a 5 percentage points higher probability of having an elder sibling with a one-tail p-value of 0.068. The mean tests in Tables 7 and 8 suggest that the World Cup fertility shock is mostly due to couples in long-term relationships including married couples.[9] To proxy for potentially confounding family background factors, we also control for the presence of an elder sibling in our main regressions.

As discussed in the background section, weak academic performance could also result from a negative selection of parents. If such a distortion was indeed at work, the three family characteristics of World Cup children, mother's age at birth, mother's education level, and household income, should all be significantly lower compared to the control group (Finer & Zolna, 2014; Font-Ribera et al., 2007; Henshaw, 1998). However, if anything these three characteristics point into the opposite direction (see Table 9).

According to Table 9, mothers of World Cup children are marginally older at the time of their births, more educated, and wealthier than mothers of control group children.[10] Despite these favorable family characteristics, World Cup children had less tutoring time than the children from the control group. Consequently, it is highly unlikely that a negative selection of families could cause an underperformance of World Cup Children at school.

4. Results

Table 10 displays our main DID regression results: *worldcup* is our DID coefficient showing the academic gap between the World Cup children and controlled students.

[9] Unfortunately, the dataset only provides information about the existence of elder (and younger) siblings, but not about their birth years and months. Therefore, we cannot examine whether the quantity-quality trade-off also affects the siblings of World Cup babies.

[10] Our simple DID estimates using family traits as outcome variables also point out that World Cup children may have marginally more favorable (at least no statistically significant differences) family characteristics (see Appendix Table A2) than children born in different years or months.

Table 11
(OLS) robustness checks with different combinations of treated months (March & April).

Variables	Statistics	Model 1	Model 2	Model 3	Model 4
math	worldcup	−0.3674*	−0.3845*	−0.3798*	−0.3972*
	(Mar & Apr)	(0.2124)	(0.2126)	(0.2146)	(0.2147)
	P>|t|	0.084	0.071	0.077	0.064
	observations	3516	3516	3516	3516
sosci	worldcup	−0.2835	−0.2971	−0.3517*	−0.3601*
	(Mar & Apr)	(0.1977)	(0.1977)	(0.2006)	(0.2008)
	P>|t|	0.152	0.133	0.080	0.073
	observations	3408	3408	3408	3408
nasci	worldcup	−0.6558***	−0.6798***	−0.6099***	−0.6283***
	(Mar & Apr)	(0.1966)	(0.1967)	(0.1989)	(0.1990)
	P>|t|	0.001	0.001	0.002	0.002
	observations	3515	3515	3515	3515
korean	worldcup	−0.2482	−0.2575	−0.2948	−0.3011
	(Mar & Apr)	(0.1832)	(0.1833)	(0.1851)	(0.1853)
	P>|t|	0.175	0.160	0.111	0.104
	observations	3514	3514	3514	3514
english	worldcup	−0.5524***	−0.5744***	−0.5747***	−0.5915***
	(Mar & Apr)	(0.2078)	(0.2079)	(0.2106)	(0.2107)
	P>|t|	0.008	0.006	0.006	0.005
	observations	3516	3516	3516	3516
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	–	–
school district fixed effect		no	no	yes	yes

Note: The same control variables as in the main regressions are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Table 12
(OLS) robustness checks with different combinations of treated months (April & May).

Variables	Statistics	Model 1	Model 2	Model 3	Model 4
math	worldcup	−0.2941	−0.2955	−0.2241	−0.2252
	(Apr & May)	(0.2162)	(0.2162)	(0.2179)	(0.2179)
	P>|t|	0.174	0.172	0.304	0.301
	observations	3516	3516	3516	3516
sosci	worldcup	−0.5526***	−0.5648***	−0.5249***	−0.5338***
	(Apr & May)	(0.2005)	(0.2004)	(0.2028)	(0.2029)
	P>|t|	0.006	0.005	0.010	0.009
	observations	3408	3408	3408	3408
nasci	worldcup	−0.4180**	−0.4294**	−0.2981	−0.3069
	(Apr & May)	(0.2004)	(0.2003)	(0.2022)	(0.2021)
	P>|t|	0.037	0.032	0.140	0.129
	observations	3515	3515	3515	3515
korean	worldcup	−0.3555*	−0.3590*	−0.2814	−0.2826
	(Apr & May)	(0.1864)	(0.1865)	(0.1879)	(0.1880)
	P>|t|	0.057	0.054	0.134	0.133
	observations	3514	3514	3514	3514
english	worldcup	−0.5942***	−0.6037***	−0.5351**	−0.5421**
	(Apr & May)	(0.2114)	(0.2114)	(0.2138)	(0.2138)
	P>|t|	0.005	0.004	0.012	0.011
	observations	3516	3516	3516	3516
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	–	–
school district fixed effect		no	no	yes	yes

Note: The same control variables as in the main regressions are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Our results confirm that students who were born approximately ten months after the 2002 World Cup perform worse than students from the controlled year and months with high statistical significance in all five major subjects. The academic performance gap between World Cup children and other students is most pronounced in English and least in Korean and Mathematics. Equation (1) can also be estimated using the ordered probit regression model. As can be seen in Appendix Table A3, the corresponding results imply that World Cup children have higher probability of performing worse on school exams than students in the control group.

We also checked the robustness of our main findings for different combinations of treated months and for two specifications with clustered standard errors. Table 11 and Table 12 report the DID coefficients of interest when using narrower measures of treated months: March and April respectively April and May.

By and large, Tables 11 and 12 show the robustness of our main regressions. Students born during the treated months in 2003 tend to perform weaker than students born during the controlled year and months. Again, World Cup children had particularly low school test scores in English but suffer less in Korean and Mathematics. Moreover, the ordered probit results corresponding to Tables 11 and 12 (cf. Appendix Tables A4 and A5) also reconfirm our view that World Cup children underperform at school.

Because we use two different cohorts for the DID design, the reported standard errors may lead to inconsistency issues due to the (possibly) heterogeneous tests that the two cohorts took. In this light, we clustered

Table 13
Placebo test results on academic outcomes.

Placebo Months			math	sosci	nasci	korean	english
school province fixed effects							
Jan	Feb	Jun	−0.1956	0.2045	0.3385*	0.3549*	0.1565
			(0.2110)	(0.1955)	(0.1959)	(0.1821)	(0.2076)
reject the null			No	No	Yes	Yes	No
Feb	Jun	Jul	−0.1567	−0.0113	0.1510	0.0874	0.1261
			(0.2044)	(0.1897)	(0.1898)	(0.1764)	(0.2011)
reject the null			No	No	No	No	No
Jun	Jul	Aug	−0.0204	0.0369	0.0061	−0.0470	0.0422
			(0.2036)	(0.1894)	(0.1892)	(0.1758)	(0.2004)
reject the null			No	No	No	No	No
Jul	Aug	Sep	0.3590*	0.1685	0.3375*	0.1974	0.4295**
			(0.1991)	(0.1852)	(0.1850)	(0.1719)	(0.1958)
reject the null			Yes	No	Yes	No	Yes
Aug	Sep	Oct	0.3211	0.1683	0.2901	0.0201	0.2806
			(0.1973)	(0.1837)	(0.1834)	(0.1704)	(0.1942)
reject the null			No	No	No	No	No
Sep	Oct	Nov	0.2018(0.1972)	0.0123	0.1446	0.0233	0.2711
				(0.1830)	(0.1832)	(0.1701)	(0.1940)
reject the null			No	No	No	No	No
Oct	Nov	Dec	0.1638	0.2083	−0.0603	−0.0637	0.0390
			(0.2004)	(0.1864)	(0.1858)	(0.1729)	(0.1971)
reject the null			No	No	No	No	No
school district fixed effects							
Jan	Feb	Jun	−0.2505	0.2034	0.3075	0.3104*	0.1128
			(0.2138)	(0.1992)	(0.1981)	(0.1844)	(0.2111)
reject the null			No	No	No	Yes	No
Feb	Jun	Jul	−0.2798	−0.0720	0.0274	−0.0319	−0.0273
			(0.2066)	(0.1927)	(0.1914)	(0.1781)	(0.2040)
reject the null			No	No	No	No	No
Jun	Jul	Aug	−0.0813	0.0162	−0.0241	−0.1363	0.0436
			(0.2068)	(0.1934)	(0.1916)	(0.1783)	(0.2041)
reject the null			No	No	No	No	No
Jul	Aug	Sep	0.3442*	0.1811	0.3005	0.1524	0.4374**
			(0.2022)	(0.1893)	(0.1875)	(0.1744)	(0.1995)
reject the null			Yes	No	No	No	Yes
Aug	Sep	Oct	0.3744*	0.1820	0.3245*	0.0668	0.3383*
			(0.2001)	(0.1874)	(0.1855)	(0.1727)	(0.1975)
reject the null			Yes	No	Yes	No	Yes
Sep	Oct	Nov	0.2026	−0.0109	0.0771	0.0470	0.2250
			(0.2000)	(0.1864)	(0.1854)	(0.1722)	(0.1974)
reject the null			No	No	No	No	No
Oct	Nov	Dec	0.1435	0.1539	−0.0878	−0.0259	0.0110
			(0.2034)	(0.1900)	(0.1881)	(0.1752)	(0.2006)
reject the null			No	No	No	No	No
Observations			3060	2959	3059	3058	3060

Note: The same control variables as in the main regression are used except for the treated months. Reject the null-hypothesis ($\theta = 0$) if $p < 0.10$. Observations from students born in the treated months and treated year are not used in these regressions. School province (district) fixed effect results are based on estimating Model 2 (Model 4).

the observations on the school level and on the school district level. The school level clustering might resolve some of the heterogeneous test issues as school teachers and curricula do not change a lot in three years. Appendix Table A6 shows the robustness check results after clustering observations on the school and school district levels. As the table shows, the coefficients are still statistically significant although the standard errors are adjusted after clustering (the corresponding ordered probit regression results are presented in Appendix Table A7). The similarity of the estimated coefficients and standard errors lend some additional credibility to the main regression results. Again the academic performance of World Cup children is worse than that of students in the control group.

To show that the control group does not exhibit statistical differences in academic test scores, we ran several tests using placebo months. Table 13 summarizes the results from testing the null hypotheses that the interaction terms equal zero when using irrelevant birth months.

As can be seen in Table 13, using an interaction term resulting from irrelevant birth months by and large exerts no statistically significant influence on academic outcome measures. This reassures us of the validity of the significant negative coefficients reported in Table 10. World Cup children indeed underperform in school tests.

Table 14 displays our main mental wellbeing DID regression results. As before, *worldcup* is our DID coefficient showing the mental wellbeing gap between the World Cup children and students in the control group.

As is evident, World Cup children fare better than students in the control group. They generally feel less depressed and have fewer suicidal impulses than students born in different years or months. Although it is not statistically significant at conventional levels, World Cup children tend to self-blame less than students in the control group. Moreover, they tend to cause less trouble among their peers. They generally exercise less bullying and also direct less violence against other students or classmates than students in the control group. The ordered probit regression results for the categorical outcome variables (i.e., depressed, suicidal, and self-reproach) also reconfirm our view that World Cup children generally exhibit better mental wellbeing than students born in different year and months (see Appendix Table A8).

As in the academic outcome regressions, we also clustered observations on the school and school district level in our mental wellbeing analysis (see Appendix Table A9). Again the statistical significance and magnitude of our clustered regression coefficients show the robustness

Table 14
(OLS) DID coefficients on mental wellbeing outcomes.

Variables	Statistics	Model 1	Model 2	Model 3	Model 4
depressed	worldcup	0.1256**	0.1271**	0.1417**	0.1417**
		(0.0579)	(0.0558)	(0.0587)	(0.0565)
	P>|t|	0.030	0.023	0.016	0.012
	observations	3566	3559	3566	3559
suicidal	worldcup	0.0967*	0.0978*	0.1098**	0.1100**
		(0.0520)	(0.0511)	(0.0526)	(0.0516)
	P>|t|	0.063	0.056	0.037	0.033
	observations	3566	3559	3566	3559
self-reproach	worldcup	0.0663	0.0643	0.0787	0.0763
		(0.0632)	(0.0618)	(0.0640)	(0.0626)
	P>|t|	0.294	0.298	0.219	0.223
	observations	3566	3559	3566	3559
bullying	worldcup	−0.0766**	−0.0770**	−0.0870***	−0.0872***
		(0.0302)	(0.0303)	(0.0308)	(0.0308)
	P>|t|	0.011	0.011	0.005	0.005
	observations	3566	3559	3566	3559
violence	worldcup	−0.0612	−0.0615	−0.0621	−0.0623
		(0.0381)	(0.0381)	(0.0390)	(0.0391)
	P>|t|	0.108	0.107	0.111	0.111
	observations	3566	3559	3566	3559
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	–	–
school district fixed effect		no	no	yes	yes

Note: The same control variables as in the main regressions are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level. The variables **depressed**, **suicidal**, and **self-reproach** are categorical where "1" refers to strong yes, "2" refers to yes, "3" refers to no, and "4" refers to strong no. Therefore, students with better mental health report higher numerical values for these variables. The variables **bullying** and **violence**, in contrast, measure the frequency of instances in which students have exhibited bullying behavior or physical aggression toward others. If students do not engage in such actions, they are assigned 0. Therefore, students who behaved well in a school context tend to have lower numerical values for these variables.

of our main empirical results that World Cup children generally have higher degrees of mental wellbeing than the students in the control group. Ordered probit regressions on categorical variables corroborate our OLS findings (see Appendix Table A10).

We also conducted the placebo tests for our mental wellbeing outcome regressions to show there is no statistical difference in mental wellbeing among students in the control group (see Table 15).

As Table 15 shows, in almost all specifications we cannot reject the null hypothesis that students born in hypothetically treated months enjoy the same level of mental wellbeing than students in the control group.

5. Discussion

Our analysis reveals strong empirical evidence that the positive fertility shock caused by the 2002 World Cup also had a significant adverse effect on students' human capital formation. Our findings, therefore, produce evidence for the existence of a trade-off between child quantity and quality in South Korea. As Tables 10–12 show, World Cup children performed worse than students in the control group in all subject areas and the effects are especially pronounced in English and less pronounced in Korean and Mathematics. At the same time we find evidence that students fare better in terms of mental wellbeing, which might be a reflection of less pressure and lower expectations from the parents of World Cup children.

Given the linguistic difference between English and Korean, the acquisition of English as a second language is particularly difficult for Korean students. Its different structure, pronunciation, and phrasing make learning the English language very time intensive for Korean students. Not surprisingly, private tutoring expenditures on English education are the highest among all academic subjects (Statistics Korea, 2019). The fact that World Cup children produce significantly lower test scores in English may therefore result from lower parental investments relative to the control group (see Table 9 and Appendix Table A2). The above line of argument does not apply - or only to a much lesser degree - to the acquisition of the Korean language and mathematics skills. Korean language skills in particular can be gained more naturally until puberty around the age of 12 or 13 (Fromkin, Rodman, & Hyams, 2014). We suspect that differences in the skill acquisition processes most likely explain why the test score gaps between World Cup children and students in the control group are less pronounced in Korean and Mathematics than they are in English.

The results of our analysis are also consistent with the notion that the parents of World Cup children have lower expectations with respect to the academic performance of their offspring. Compared to students born in different years and months, World Cup children might therefore feel less pressure from their parents. Empirical evidence suggests that students facing high parental expectations get more stress from low test scores (Lee & Kang, 2018; Shin et al., 2018). This stress factor then lowers the mental wellbeing measure or deteriorates the mental health statuses of adolescents (Almroth, László, Kosidou, & Galanti, 2019; Ma, Siu, & Tse, 2018). World Cup children, in contrast, exhibit generally higher degrees of mental wellbeing than students born in different years or months (see Table 14 and Appendix Table A9). They feel less depressed and have fewer suicidal impulses than students in the control group. In this light, our results indeed insinuate that World Cup children experienced less academic pressure from their parents than students in the control group. The empirical results corroborate our view that both parental expectations and investment in human capital formation are significantly lower for World Cup children which then leads to low test scores but content students.

The alternative mechanism via a negative selection of parents, in contrast, is very unlikely. First and foremost, mothers of World Cup children are marginally older at the time of birth, more educated, and have higher incomes than mothers of children born in different years or months. Previous empirical studies suggest that such a selection of mothers would indeed lead to favorable academic and mental health child outcome. Therefore this selection of mothers might have even caused an attenuation of our results. Similarly, if a selection of mothers with a lower aversion against risky behavior was driving our results (unfortunately we can neither confirm nor reject this hypothesis), we would expect their children to underperform at school and to exhibit severe mental health problems which is of course not the case. We therefore argue that our regression results are a reflection of the child quantity-quality trade-off in South Korea.

Table 15
Placebo test results on mental wellbeing outcomes.

Placebo Months			depressed	suicidal	self-reproach	bullying	violence
school province fixed effects							
Jan	Feb	Jun	0.0243	0.0639	0.0880	0.0215	0.0253
			(0.0638)	(0.0582)	(0.0695)	(0.0362)	(0.0454)
reject the null			No	No	No	No	No
Feb	Jun	Jul	0.0110	0.0182	0.0064	0.0173	−0.0200
			(0.0621)	(0.0566)	(0.0676)	(0.0353)	(0.0441)
reject the null			No	No	No	No	No
Jun	Jul	Aug	0.0171	−0.0141	−0.0329	−0.0018	−0.0195
			(0.0614)	(0.0560)	(0.0669)	(0.0349)	(0.0436)
reject the null			No	No	No	No	No
Jul	Aug	Sep	−0.0256	−0.0605	−0.0647	0.0193	0.0120
			(0.0601)	(0.0548)	(0.0654)	(0.0341)	(0.0427)
reject the null			No	No	No	No	No
Aug	Sep	Oct	0.0230	−0.0099	−0.0195	0.0573*	0.0503
			(0.0596)	(0.0543)	(0.0649)	(0.0338)	(0.0423)
reject the null			No	No	No	Yes	No
Sep	Oct	Nov	−0.0569	−0.0139	0.0037	0.0662	0.0489
			(0.0596)	(0.0544)	(0.0649)	(0.0338)	(0.0424)
reject the null			No	No	No	Yes	No
Oct	Nov	Dec	−0.0788	−0.0791	−0.0349	0.0290	0.0254
			(0.0604)	(0.0552)	(0.0659)	(0.0344)	(0.0430)
reject the null			No	No	No	No	No
school district fixed effects							
Jan	Feb	Jun	0.0244	0.0496	0.0766	0.0319	0.0177
			(0.0651)	(0.0591)	(0.0706)	(0.0371)	(0.0467)
reject the null			No	No	No	No	No
Feb	Jun	Jul	0.0013	−0.0078	−0.0124	0.0169	−0.0255
			(0.0630)	(0.0572)	(0.0684)	(0.0360)	(0.0453)
reject the null			No	No	No	No	No
Jun	Jul	Aug	0.0124	−0.0195	−0.0320	−0.0053	−0.0207
			(0.0626)	(0.0568)	(0.0679)	(0.0357)	(0.0450)
reject the null			No	No	No	No	No
Jul	Aug	Sep	−0.0259	−0.0516	−0.0678	0.0109	0.0063
			(0.0611)	(0.0555)	(0.0664)	(0.0349)	(0.0439)
reject the null			No	No	No	No	No
Aug	Sep	Oct	0.0167	−0.0042	−0.0246	0.0560	0.0513
			(0.0607)	(0.0551)	(0.0659)	(0.0346)	(0.0436)
reject the null			No	No	No	No	No
Sep	Oct	Nov	−0.0564	−0.0132	0.0007	0.0780**	0.0416
			(0.0610)	(0.0553)	(0.0662)	(0.0348)	(0.0438)
reject the null			No	No	No	Yes	No
Oct	Nov	Dec	−0.0878	−0.0856	−0.0198	0.0427	0.0337
			(0.0617)	(0.0560)	(0.0671)	(0.0352)	(0.0444)
reject the null			No	No	No	No	No
Observations			3100	3100	3100	3100	3100

Note: The same control variables as in the main regression are used except for the treated months. Reject the null-hypothesis ($\theta = 0$) if $p < 0.10$. Observations from students born in the treated months and treated year are not used in these regressions. School province (district) fixed effect results are based on estimating Model 2 (Model 4).

Last but not least, we would like to note that the empirical findings presented in this paper also hint at the adverse consequences that are associated with a competitive educational environment. South Korea is known for its pervasive "education fever" and relentless educational system aimed at qualifying students for admissions to prestigious high schools and universities (Anderson & Kohler, 2013; Lee, 2005). Given the substantial educational expenses and the high expectations imposed by parents, students in South Korea experience greater stress and poorer mental health compared to their peers in other middle and high income countries (Rudolf & Bethmann, 2022), which is reflected, among other things, in a high suicide rate among young Koreans.[11] In such a competitive environment, reducing educational expenditures and parental expectations may actually increase the mental wellbeing and contentment of students.

6. Conclusion

The Korean National Football team experienced miraculous match results during the home World Cup in the June of 2002. The events caused a euphoria among Koreans that led to a temporary and significant increase in the country's fertility rate in the subsequent spring. Given its long duration and unforeseen nature, the football tournament hence provides us with the quasi-experimental event needed for statistical identification. In a first step, we showed that the World Cup indeed had a significant positive impact on South Korean fertility. Second, we used the episode to study the Beckerian trade-off between child quantity and quality. Being more numerous, we hypothesized that the "World Cup children" were likely to show a lower academic performance in major school subjects. Last, we changed our perspective and checked whether the event also affected the children's mental wellbeing.

Our empirical results show that World Cup children – born approximately ten months after the tournament – tend to underperform in all five academic subjects. The results are more pronounced in English and less pronounced in Korean and Mathematics. Since these findings most likely result from inferior parental investments, they are in line with the

[11] The average suicide rate among 15–19 years old teenagers in the 38 OECD countries is 6.26 (per 100,000 population) with a standard deviation of 0.59. In South Korea this rate is 9.90. Source: World Health Organization (Suicide Rate Estimates, Crude, 15–19) at https://apps.who.int/gho/data/view.main.MHSUICIDE15TO19v [last accessed on October 9th, 2023].

Beckerian notion of a trade-off between child quantity and quality. Our mental wellbeing regression results, in turn, indicate that World Cup children may experience less pressure from their parents as they generally feel less depressed, have fewer suicidal impulses, exert less self-blame, exercise less bullying, and direct less violence against classmates than students in the control group.

Our research adds to the existing literature by producing additional empirical evidence in favor of the existence of a trade-off between the quantity and quality of children. In our empirical strategy we used an unusually long-lasting exogenous shock to South Korean fertility caused by the 2002 World Cup. Two contributions of our work are worth mentioning. First, we complemented the existing studies with their focus on Western countries by providing corroborative evidence from an East Asian country. Second, we also added the children's perspective. Interestingly, we found evidence that children fare better in terms of mental wellbeing despite underperforming at school. It goes without saying that both of these contributions should not be viewed as final or definite answers but rather as inspirations for further work in that same direction.

Ethical Statement

(1) This material is the authors' own original work, which has not been previously published elsewhere.
(2) The paper is not currently being considered for publication elsewhere.
(3) The paper reflects the authors' own research and analysis in a truthful and complete manner.
(4) The paper properly credits the meaningful contributions of co-authors and co-researchers.
(5) The results are appropriately placed in the context of prior and existing research.
(6) The data collected by Korea Employment Information Service is publicly available for research purposes.
(7) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
(8) All authors have been personally and actively involved in substantial work leading to the paper and will take public responsibility for its content.

The violation of the Ethical Statement rules may result in severe consequences.

I agree with the above statements and declare that this submission follows the policies outlined in the Guide for Authors and in the Ethical Statement.

CRediT authorship contribution statement

Dirk Bethmann: Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing. **Jae Il Cho:** Conceptualization, Formal analysis, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no financial and personal conflicts of interest.

Data availability

Data will be made available on request.

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Appendix

We conducted a series of statistical tests to check whether the increases of monthly new births in March, April, and (or) May of 2003 are in fact significant. For this purpose, we used the Monthly New Borns dataset from Statistics Korea (2021) from 2000 to 2020 and analyzed the data using heteroskedasticity robust OLS and Tobit regressions after controlling for both years and months. Table A1 shows the results from these tests. Note that the null-hypotheses assume no change in new births.

Table A1
Hypotheses Testing on Monthly New Birth with World Cup Dummies

treated month(s)	test type	regression type	test statistic	reject the null
2003 Mar	*t*-test	ols	1.96	Yes
		tobit	2.11	Yes
2003 Apr	*t*-test	ols	2.55	Yes
		tobit	2.75	Yes
2003 May	*t*-test	ols	0.96	No
		tobit	1.03	No
2003 Mar & Apr	f-test	ols	3.26	Yes
		tobit	3.77	Yes
2003 Mar & May	f-test	ols	8.49	Yes
		tobit	9.82	Yes
2003 Mar & Apr & May	f-test	ols	5.95	Yes
		tobit	6.88	Yes

Note: Reject the null-hypothesis if [P>|t-statistic|] < 0.10 or [P > f-statistic] < 0.10. The number of observations is 252.

As Table A1 shows, the number of new births increased significantly in the spring of 2003. The rejection of joint hypothesis tests using March, April, and (or) May of 2003 reconfirms our view that Korea indeed experienced a temporary increase in fertility roughly ten months after the World Cup.

Mean difference tests in Table 9 analyze the unconditional means of control and treatment groups, showing that the mothers of World Cup children generally show marginally better (family) characteristics (i.e., older at the time of their birth, more educated, and have higher household income). These family traits of World Cup children can still be observed even if we control for gender and regional fixed effects. The results in Table A2 are the estimated β_3 coefficients of the following regression model:

$$Y = \beta_0 + \beta_1 Year + \beta_2 Treated\ Months + \beta_3 World\ Cup + \beta_4\ Gender + \delta_{region\ FE} + \varepsilon$$

Y denotes outcome variables such as mother's age, mother's education level, household income, and tutoring time. $\delta_{region\ FE}$ denotes school province or school district fixed effects.

Table A2
Family Traits of World Cup Children

Variables	Statistics	Model A	Model B
eldersibling	worldcup	0.0393	0.0428
		(0.0359)	(0.0363)
	P>|t|	0.273	0.238
	observations	3972	3972
mother's age	worldcup	0.2726	0.2574
		(0.2754)	(0.2808)
	P>|t|	0.322	0.359
	observations	3729	3729
moeduc	worldcup	0.0788	0.0690
		(0.0701)	(0.0682)
	P>|t|	0.261	0.312
	observations	3711	3711
income	worldcup	155.5359	147.8808
		(192.5402)	(188.8262)
	P>|t|	0.419	0.434
	observations	3794	3794
tutortime	worldcup	−16.0236***	−15.0060**
		(6.1668)	(6.1684)
	P>|t|	0.009	0.015
	observations	3965	3965
school province fixed effect		yes	no
school district fixed effect		no	yes

Note: Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Table A3
(Ordered-Probit) DID Coefficients on Academic Outcomes

Variables	Statistics	Model1	Model2	Model3	Model4
math	**worldcup**	−0.1408*	−0.1442*	−0.1416*	−0.1456*
		(0.0800)	(0.0800)	(0.0816)	(0.0817)
	P > |t|	0.078	0.072	0.083	0.075
	observations	3516	3516	3516	3516
sosci	**worldcup**	−0.2366***	−0.2428***	−0.2604***	−0.2649***
		(0.0804)	(0.0804)	(0.0820)	(0.0820)
	P > |t|	0.003	0.003	0.001	0.001
	observations	3408	3408	3408	3408
nasci	**worldcup**	−0.2383***	−0.2460***	−0.2149***	−0.2213***
		(0.0793)	(0.0793)	(0.0809)	(0.0809)
	P > |t|	0.003	0.002	0.008	0.006
	observations	3515	3515	3515	3515
korean	**worldcup**	−0.1515*	−0.1547**	−0.1526*	−0.1547*
		(0.0786)	(0.0787)	(0.0802)	(0.0803)
	P > |t|	0.054	0.049	0.057	0.054
	observations	3514	3514	3514	3514
english	**worldcup**	−0.2803***	−0.2874***	−0.2937***	−0.2997***
		(0.0801)	(0.0802)	(0.0818)	(0.0819)
	P > |t|	0.000	0.000	0.000	0.000
	observations	3516	3516	3516	3516
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	–	–
school district fixed effect		no	no	yes	yes

Note: The table shows the estimated DID coefficients from equation (1) for the five academic outcome variables. All regressions control for year, treated months, and individual covariates as they were listed in Section III. A total of 163 school districts or 17 school provinces is also controlled in the regressions. For income and allowance, natural logarithm values are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Table A4
(Ordered-Probit) Robustness Checks with. Different Combinations of Treated Months (March & April)

Variables	Statistics	Model1	Model2	Model3	Model4
math	worldcup	−0.1253	−0.1331	−0.1409	−0.1492
	(Mar & Apr)	(0.0908)	(0.0909)	(0.0929)	(0.0930)
	P>|t|	0.168	0.143	0.129	0.109
	observations	3516	3516	3516	3516
sosci	worldcup	−0.1475	−0.1541*	−0.1811*	−0.1856**
	(Mar & Apr)	(0.0914)	(0.0915)	(0.0934)	(0.0935)
	P>|t|	0.107	0.092	0.053	0.047
	observations	3408	3408	3408	3408
nasci	worldcup	−0.3026***	−0.3150***	−0.2901***	−0.3001***
	(Mar & Apr)	(0.0900)	(0.0901)	(0.0920)	(0.0921)
	P>|t|	0.001	0.000	0.002	0.001
	observations	3515	3515	3515	3515
korean	worldcup	−0.1015	−0.1073	−0.1296	−0.1343
	(Mar & Apr)	(0.0893)	(0.0894)	(0.0913)	(0.0914)
	P>|t|	0.256	0.230	0.156	0.142
	observations	3514	3514	3514	3514
english	worldcup	−0.2407***	−0.2518***	−0.2627***	−0.2721***
	(Mar & Apr)	(0.0908)	(0.0909)	(0.0929)	(0.0930)
	P>|t|	0.008	0.006	0.005	0.003
	observations	3516	3516	3516	3516
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	–	–
school district fixed effect		no	no	yes	yes

Note: The same control variables as in the main regressions are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Table A5
(Ordered-Probit) Robustness Checks with. Different Combinations of Treated Months (April & May)

Variables	Statistics	Model1	Model2	Model3	Model4
math	worldcup	−0.1409	−0.1423	−0.1218	−0.1232
	(Apr & May)	(0.0923)	(0.0923)	(0.0941)	(0.0941)
	P>|t|	0.127	0.123	0.196	0.190
	observations	3516	3516	3516	3516
sosci	worldcup	−0.2713***	−0.2774***	−0.2692***	−0.2740***
	(Apr & May)	(0.0927)	(0.0927)	(0.0944)	(0.0944)
	P>|t|	0.003	0.003	0.004	0.004
	observations	3408	3408	3408	3408
nasci	worldcup	−0.1882**	−0.1942**	−0.1390	−0.1438
	(Apr & May)	(0.0916)	(0.0916)	(0.0934)	(0.09340)
	P>|t|	0.040	0.034	0.137	0.124
	observations	3515	3515	3515	3515
korean	worldcup	−0.1550*	−0.1575*	−0.1226	−0.1240
	(Apr & May)	(0.0908)	(0.0908)	(0.0926)	(0.0926)
	P>|t|	0.088	0.083	0.185	0.181
	observations	3514	3514	3514	3514
english	worldcup	−0.2836***	−0.2888***	−0.2748***	−0.2790***
	(Apr & May)	(0.0925)	(0.0926)	(0.0944)	(0.0944)
	P>|t|	0.002	0.002	0.004	0.003
	observations	3516	3516	3516	3516
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	–	–
school district fixed effect		no	no	yes	yes

Note: The same control variables as in the main regressions are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Table A6
(OLS) Academic Robustness Checks Using Clustered Standard Errors

Variables	Statistics	Model 5	Model 6	Model 7	Model 8
math	worldcup	−0.3372*	−0.3436*	−0.3372*	−0.3436*
		(0.1921)	(0.1925)	(0.1845)	(0.1837)
	P>|t|	0.08	0.075	0.069	0.063
	clusters	876	876	163	163
sosci	worldcup	−0.4762***	−0.4887***	−0.4762**	−0.4887**
		(0.1844)	(0.1838)	(0.2116)	(0.2098)
	P>|t|	0.01	0.008	0.026	0.021
	clusters	858	858	163	163
nasci	worldcup	−0.5371***	−0.5516***	−0.5371***	−0.5516***
		(0.1809)	(0.1804)	(0.2006)	(0.1997)
	P>|t|	0.003	0.002	0.008	0.006
	clusters	876	876	163	163
korean	worldcup	−0.3578**	−0.3627**	−0.3578**	−0.3627**
	P>|t|	0.036	0.033	0.054	0.05
	clusters	874	874	163	163
english	worldcup	−0.6126***	−0.6253***	−0.6126***	−0.6253***
		(0.1850)	(0.1846)	(0.1852)	(0.1834)
	P>|t|	0.001	0.001	0.001	0.001
	clusters	876	876	163	163
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	yes	yes
school level clustering		yes	yes	no	no
school district level clustering		no	no	yes	yes

Note: The same control variables as in the main regressions are used in the school level or school district level standard error clustering regression. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Table A7
(Ordered-Probit) Academic Robustness Checks Using Clustered Standard Errors

Variables	Statistics	Model5	Model6	Model7	Model8
math	worldcup	−0.1408*	−0.1442*	−0.1408*	−0.1442*
		(0.0823)	(0.0826)	(0.0780)	(0.0778)
	P>|t|	0.087	0.081	0.071	0.064
	clusters	876	876	163	163
sosci	worldcup	−0.2366***	−0.2428***	−0.2366**	−0.2428**
		(0.0857)	(0.0854)	(0.0988)	(0.0981)
	P>|t|	0.006	0.004	0.017	0.013
	clusters	858	858	163	163
nasci	worldcup	−0.2383***	−0.2460***	−0.2383***	−0.2460***
		(0.0825)	(0.0825)	(0.0930)	(0.0925)
	P>|t|	0.004	0.003	0.010	0.008
	clusters	876	876	163	163
korean	worldcup	−0.1515*	−0.1547*	−0.1515*	−0.1547*
		(0.0834)	(0.0832)	(0.0913)	(0.0910)
	P>|t|	0.069	0.063	0.097	0.089
	clusters	874	874	163	163
english	worldcup	−0.2803***	−0.2874***	−0.2803***	−0.2874***
		(0.0826)	(0.0824)	(0.0813)	(0.0806)
	P>|t|	0.001	0.000	0.001	0.000
	clusters	876	876	163	163
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	yes	yes
school level clustering		yes	yes	no	no
school district level clustering		no	no	yes	yes

Note: The same control variables as in the main regressions are used in the school level or school district level standard error clustering regression. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Table A8
(Ordered-Probit) DID Coefficients on Mental Wellbeing Outcomes

Variables	Statistics	Model1	Model2	Model3	Model4
depressed	worldcup	0.1720**	0.1864**	0.2060**	0.2196**
		(0.0868)	(0.0879)	(0.0890)	(0.0901)
	P>|t|	0.048	0.034	0.021	0.015
	observations	3566	3559	3566	3559
suicidal	worldcup	0.1670*	0.1738*	0.1955**	0.1992**
		(0.0939)	(0.0947)	(0.0968)	(0.0976)
	P>|t|	0.075	0.066	0.043	0.041
	observations	3566	3559	3566	3559
self-reproach	worldcup	0.1006	0.1032	0.1214	0.1240
		(0.0837)	(0.0843)	(0.0857)	(0.0862)
	P>|t|	0.229	0.221	0.156	0.151
	observations	3566	3559	3566	3559
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	–	–
school district fixed effect		no	no	yes	yes

Note: The same control variables as in the main regressions are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

Table A9
(OLS) Diff-in-Diff Results with Clustered Standard Errors

Variables	Statistics	Model 5	Model 6	Model 7	Model 8
depressed	worldcup	0.1256**	0.1271**	0.1256**	0.1271**
		(0.0556)	(0.0536)	(0.0562)	(0.0552)
	P>|t|	0.024	0.018	0.027	0.023
	clusters	564	563	155	155
suicidal	worldcup	0.0967*	0.0978*	0.0967*	0.0978*
		(0.0527)	(0.0510)	(0.0524)	(0.0508)
	P>|t|	0.067	0.055	0.067	0.056
	clusters	564	563	155	155
self-reproach	worldcup	0.0663	0.0643	0.0663	0.0643
		(0.0657)	(0.0641)	(0.0691)	(0.0668)
	P>|t|	0.314	0.316	0.339	0.337
	clusters	564	563	155	155
bullying	worldcup	−0.0766**	−0.0770**	−0.0766**	−0.0770**
		(0.0359)	(0.0360)	(0.0375)	(0.0375)
	P>|t|	0.033	0.033	0.043	0.042
	clusters	564	563	155	155
violence	worldcup	−0.0612	−0.0615	−0.0612	−0.0615
		(0.0443)	(0.0445)	(0.0411)	(0.0411)
	P>|t|	0.168	0.167	0.138	0.137
	clusters	564	563	155	155
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	yes	yes
school level clustering		yes	yes	no	no
school district level clustering		no	no	yes	yes

Note: The same control variables as in the main regressions are used. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level. The variables **depressed**, **suicidal**, and **self-reproach** are categorical where "1" refers to strong yes, "2" refers to yes, "3" refers to no, and "4" refers to strong no. Therefore, students with better mental health report higher numerical values for these variables. The variables **bullying** and **violence**, in contrast, measure the frequency of instances in which students have exhibited bullying behavior or physical aggression toward others. If students do not engage in such incidents, they are assigned 0. Therefore, students who behaved well in a school context tend to have lower numerical values for these variables.

Table A10
(Ordered-Probit) Diff-in-Diff Results with Clustered Standard Errors

Variables	Statistics	Model5	Model6	Model7	Model8
depressed	worldcup	0.1720**	0.1864**	0.1720**	0.1864**
		(0.0830)	(0.0839)	(0.0826)	(0.0860)
	P>|t|	0.038	0.026	0.037	0.030
	clusters	564	563	155	155
suicidal	clusters	0.1670*	0.1738*	0.1670*	0.1738*
		(0.0949)	(0.0940)	(0.0941)	(0.0934)
	P>|t|	0.078	0.064	0.076	0.063
	clusters	564	563	155	155
self-reproach	worldcup	0.1006	0.1032	0.1006	0.1032
		(0.0876)	(0.0880)	(0.0918)	(0.0921)
	P>|t|	0.250	0.241	0.273	0.263
	clusters	564	563	155	155
health controlled		no	yes	no	yes
school province fixed effect		yes	yes	yes	yes
school level clustering		yes	yes	no	no
school district level clustering		no	no	yes	yes

Note: The same control variables as in the main regressions are used in the school level or school district level standard error clustering regression. Standard errors are in parentheses. *,**,*** denote statistical significance at the 10%, 5% and 1% level.

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