The Economic and Social Review, Vol. 46, No. 4, Winter, 2015, pp. 511–519

The Relative Age Effect and Under-21 Irish Association Football: A Natural Experiment and Policy Recommendations

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Abstract: A relative age effect refers to the presence of a bias towards relatively older children assembled collectively within a selection year. We consider this in association football (soccer) for Republic of Ireland under twenty-one international footballers over two intervals: from November 1981 to November 1994 and from September 2007 to May 2013. As the registration date for organised soccer in Ireland changed between both periods, these intervals provide scope for a natural experiment to test for a shifting relative age effect. The study confirms the existence of a relative age effect, with a selection bias toward players born in the earlier months of the registration year for both intervals.

I INTRODUCTION

A relative age effect (hereafter RAE) refers to a bias towards relatively older children assembled collectively within a selection year. For association football (soccer), international comparisons of RAE are difficult as policies adopted by national soccer associations vary between countries. Examples of these variations include different playing environments, coaching methods and institutional structures.[1] In the case of Ireland, the most important policy change occurred in 1997 when the cut-off date for registration to participate in competitive youth soccer shifted backward from August 1st to January 1st.

[1] The term institutional structure refers to the primary institution in a state that organises soccer. This often differs for children as they may register to play soccer with schools, local communities or national soccer association leagues.

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Using this policy change as the basis for a natural experiment, we access data for male under twenty-one (U-21) international squads in Ireland between November 1981 and November 1994, and from September 2007 to May 2013. We test for the presence of RAE and question whether it shifted from August to January, favouring players born earlier in the calendar year. Previous research concerning RAE has not accessed country specific historical data to the extent here, where date of birth observations are up to thirty-four years apart.

The U-21 category of footballer is chosen due to their selection to represent Ireland at an elite level, their common succession to the status of senior player and their lengthy experience within a youth structure that grouped players chronologically within a uniform age cut-off date. The competitive nature and high regard associated with U-21 soccer ensures a commitment to achieving success across countries, guaranteeing a true assessment of Ireland's youth talent.

The importance of age effect studies for Irish soccer is twofold. First, this study offers an insight to the limits of structuring the sport by chronological age. This model of organising youth soccer seeks to ensure fairness by adopting an age cut-off date. Thus, this study is motivated by inequalities created by RAE. Such imbalances are in conflict with the Irish Sports Council's values for youth sport which aim to increase participation. A second relevance relates to talent development, another concern of the Irish Sports Council. The results presented here identify a potential constraint on developing elite talent and the ultimate performance of the Irish national soccer team. Adopting policies to negate RAE in Irish soccer can improve our talent identification process at a national level. We conclude with policy recommendations aimed at reducing the impact of RAE in Irish soccer to discourage dropout and improve national performance.

II A BRIEF LOGIC OF THE RELATIVE AGE EFFECT

When physiological, cognitive and social advantages exist between children assembled in age groupings, those born in the earliest quarter of a registration period are often identified as talented. This produces a systematic bias in the identification process, skewing the birth-date distribution of elite players. This has been subject to extensive research in soccer (Helson, Van Winckel and Williams, 2005; Cobley, Schorer and Baker, 2008; Helsen, Baker, Michiels, Schorer, Van Winckel and Williams, 2012).

Central to categorising children within a chronological age group is the presence of consistent age bands throughout youth soccer. A child born in

January will persistently have an eleven-month advantage over December born children for the duration of their status as a youth footballer. These advantages, possessed by relatively older children, allow for recurring selection, greater practice levels, selection for higher standard teams and improved mentoring.

From a basis of relative maturity and initial success, a set of behaviours is evoked from both players and mentors that reinforce an early definition of talent. Psychological mechanisms are suggested to explain the reinforcement of RAE (Rosenthal, 1974; Weiner, 1986). Less advanced children can encounter aggravation due to lower amounts of playing time, provoking potential dropout. In contrast, advanced maturity allows comparably superior skills such as agility or coordination complement on-going selection. These children can form a positive psychological state that originated from initial success.

III DATA AND METHODS

We examine Irish male U-21 international footballers before and after a policy change in 1997, where the date of registration for organised youth soccer reverted from August 1st to January 1st. Data is collected for two intervals before and after this adjustment. For the first period (November 1981-November 1994), footballers participate under a cut-off date of August 1st. For the second period (September 2007-May 2013), footballers participate under a cut-off date of January 1st. Dates of birth are sourced from official match day programmes of the Football Association of Ireland and the official websites of parent clubs.[2] For the first interval, U-21 players born on or after August 1st 1960 are included in the sample. U-21 players born on or after January 1st 1986 are included for the second interval. All squads for qualification matches, playoff ties and friendlies are confirmed from UEFA records. Players born after August 1960 and January 1986 that did not represent Ireland at a U-21 level (while still eligible) given their appearance at a senior level are included in the sample. As these players perform on the highest international soccer level, their elite status is assumed.

From November 1981 to November 1994, 87 observations are collected. Data is available for the U-21 squads in the years 1981, 1985, 1987, 1991 and 1994. There are eight missing dates of birth over these five squads (n=79). A total of 127 observations are recorded from September 2007 to May 2013.[3] Three

[2] To ensure the accuracy of the data two further online databases are consulted.

[3] A customary induction of new players occurred during this second interval after Ireland's qualification campaigns ended allowing a relatively larger sample. This induction of greater numbers of new players does not occur during the first interval. At times during this first interval, the Irish international U-21 team did not enter European competitions.

samples are acquired in total, two are for the time periods under analysis and a third for a combined sample across all years. To test for RAE a series of non-parametric statistical tests are used to measure differences between the expected monthly birth-date distributions with the observed distribution for all the samples.

In line with similar RAE studies, a chi-square goodness of fit test is conducted within the three samples: 1981 to 1994, 2007 to 2013 and the combined sample from 1981 to 2013. A Kolmogorov-Smirnov one-sample test is carried out to compare the observed distribution with the expected monthly birth-date distributions within and between the samples. A Friedman test is used to compare the distribution of dates of birth between the first and second interval. To control for population, the observed distribution of U-21 players for both intervals is compared to aggregate statistics for registered male births during the years the players sampled are born. These statistics are retrieved from the Irish Central Statistics Office.

IV RESULTS

The birth-date distribution for the U-21 Irish international soccer team over the calendar year for both intervals is displayed in Table 1. Table 2 arranges players by month of birth so that Interval 1 represents the first month of a registration year for both samples. Therefore in Table 2, column one for the 1981-1994 row presents data for the month of August.

Table 1: *Birth-date Distribution by Calendar Year for U-21 Irish Internationals*

	Month of Birth												
Interval	*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Total*
1981-1994	3	2	6	5	2	7	3	12	7	15	13	4	79
2007-2013	22	13	8	8	14	4	11	10	9	15	6	7	127
Interval	*Percentage of Total*												
1981-1994	3.8	2.5	7.6	6.3	2.5	8.9	3.8	15.2	8.9	19.0	16.5	5.1	100
2007-2013	17.3	10.2	6.3	6.3	11.0	3.1	8.7	7.9	7.1	11.8	4.7	5.5	100

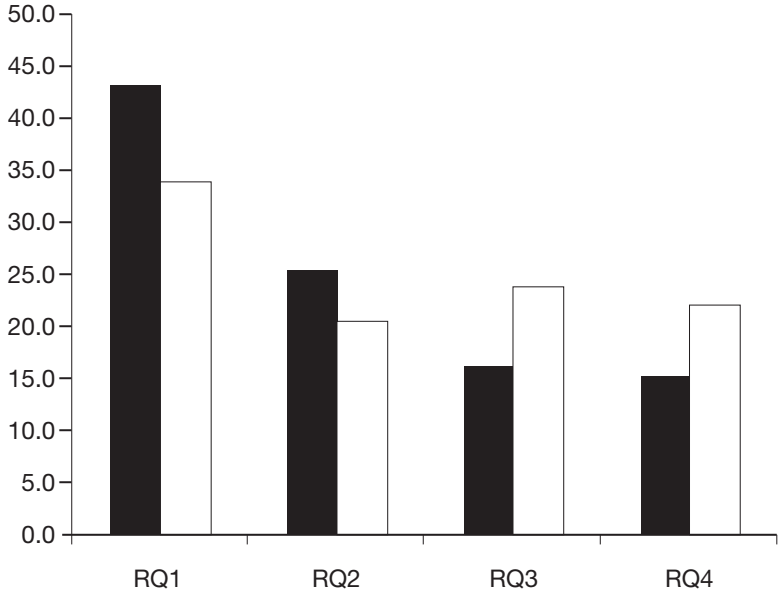
Figure 1 is a graphical representation of the data presented in Table 2 for both samples. Data is presented in quarterly form. Registration quarter 1 (RQ1) for 1981-1994 data represents the months August to October, RQ2 equates to November to January, and so on. Quarterly data for 2007-2013 sample

corresponds to the regular quarters of the calendar year. RQ1 for both periods displays evidence of a bias towards children born in the months just after the registration cut-off date.

Table 2: *Birth-date Distribution by Registration Year for U-21 Irish Internationals*

	Month of Birth												
Interval	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*Total*
1981-1994	12	7	15	13	4	3	2	6	5	2	7	3	79
2007-2013	22	13	8	8	14	4	11	10	9	15	6	7	127
Interval	*Percentage of Total*												
1981-1994	15.2	8.9	19.0	16.5	5.1	3.8	2.5	7.6	6.3	2.5	8.9	3.8	100
2007-2013	17.3	10.2	6.3	6.3	11.0	3.1	8.7	7.9	7.1	11.8	4.7	5.5	100

Figure 1: *Percentage Birth-date Distribution by Registration Quarter*



The months August, September and October account for 43.1 per cent of the observations during the time period 1981-1994 and 33.9 per cent for January, February and March from 2007-2013. From 1981 1994, RQ2 displays the second highest number of recorded births (25.4 per cent), RQ3 the third highest (16.3 per cent) and RQ4 (15.2 per cent) the lowest number of observations. In the second time period RQ2, RQ3 and RQ4 represent 20.4 per cent, 23.7 per cent and 22.0 per cent of the 2007 to 2013 population respectively.

Table 3 aggregates the data to show the distribution of U-21 Irish internationals by registration year from 1981-1994 and from 2007-2013. The combined sample displays evidence of a bias towards those born shortly after the cut-off date. Month 1 (August pre-1997, January post-1997) records the most observations (16.5 per cent). The quarterly data presents similar findings with Quarter 1 (August to October pre-1997, January to March post-1997) accounting for 37.4 per cent of all births. This is followed by Quarter 2 (22.3 per cent), Quarter 3 (20.9 per cent) and finally Quarter 4 (19.4 per cent).

Table 3: *Ireland U-21 International Births by Month and Quarter (1981-1994 and 2007-2013)*

Month / Quarter of Birth (1981-1994 and 2007-2013)											
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
34	20	23	21	18	7	13	16	14	17	13	10
77 (37.4%)			46 (22.3%)			43 (20.9%)			40 (19.4%)		

A chi-square test is conducted within all three samples with the null hypothesis assuming no difference in the distribution of birth dates in each. The time period from 1981 to 1994 confirms a statistically significant difference between the actual and expected distribution of births ($p<0.01$, $\chi^2 = 33.25$). The 2007 to 2013 time period also displays a statistically significant result ($p<0.01$, $\chi^2 = 24.95$), in addition to the aggregate sample from 1981 to 2013 ($p<0.01$, $\chi^2 = 31.55$). These three results confirm deviations in the distribution of observed births across the three periods when compared to the expected distribution.

Statistically significant effects are found using the Kolmogorov-Smirnov one-sample test for both intervals when comparing the samples against the expected distribution ($p<0.01$ 1981-1994 and $p<0.10$ 2007-2013). Additionally, statistically significant effects are discovered using the Kolmogorov-Smirnov test to compare between distributions when investigating a shifting bias ($p<0.01$ 1981-1994 when compared to 2007-2013). The Friedman test reports a statistically significant difference when comparing the first with the second interval. This result confirms that the distribution of birth dates between both samples has changed over the period ($p<0.05$, $\chi^2 = 4.31$ when comparing 1981-1994 to 2007-2013). This further supports the view of a shifting bias for Irish U-21 internationals. These results are consistent with studies that consider the impact of changing the registration date (Musch and Hay, 1999; Helsen, Starkes and Van Winckel, 2000: Cobley *et al*., 2008; Ostapczuk and Musch, 2013).

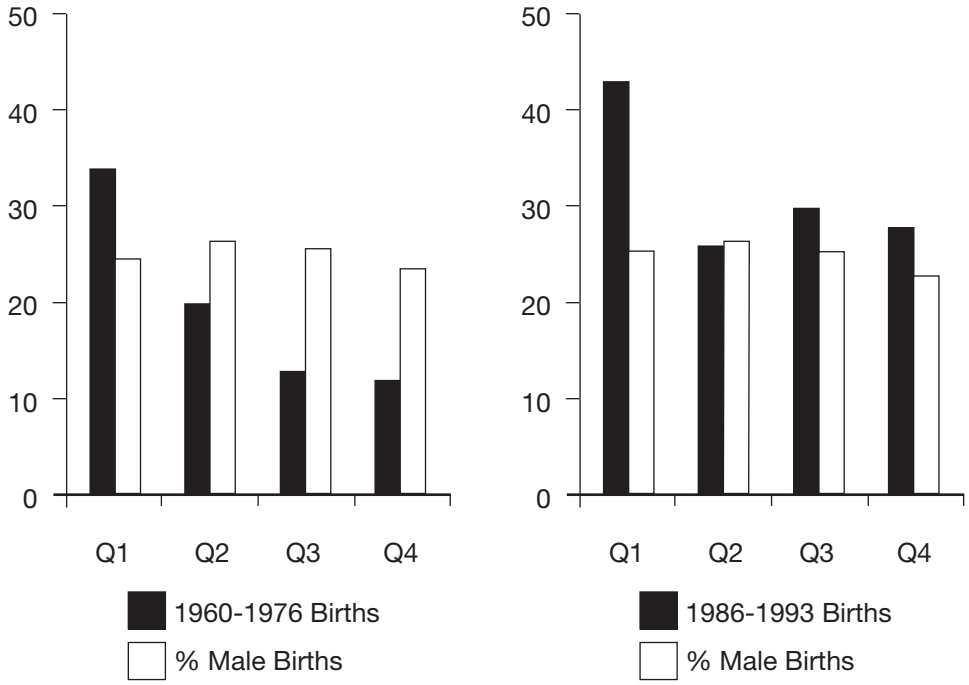
Finally, a statistically significant effect is found using the Kolmogorov-Smirnov one-sample test over the entire sample from 1981 through to 2013,

when players are categorised by the first month of the registration year ($p<0.01$ 1981-2013). To ensure that the observed relative age effect and shifting bias is not a consequence of the distribution of male births in Ireland, population statistics for the years under assessment are accessed. Birth statistics for males in Ireland for the intervals under analysis is approximately even for both periods and presented in Table 4 and Figure 2 (Central Statistics Office, 2013).

Table 4: *Male Birth-date Distribution from 1960-1972 and from 1986-1993*

Years	*Q1*	*Q2*	*Q3*	*Q4*	*Total*
1960-1976	138,104	148,087	143,280	131,351	560,822
1986-1993	56,480	56,360	56,713	51,258	222,811
Years		*Percentage of Total*			*Total*
1960-1976	24.6	26.4	25.5	23.4	100
1986-1993	25.3	26.2	25.4	22.9	100

Figure 2: *Comparison of Male Birth-date Distribution per Quarter: 1960-1972 and 1986-1993*



V CONCLUSION

The findings here provide evidence of RAE in Irish U-21 international football over two time periods, at an aggregate level and a shifting bias when the cut-off date is changed. These findings have consequences for national bodies that aim to increase participation (prevent dropout) and foster elite performance. In light of the results, we conclude with strategies to minimise age biases that should be of interest to policymakers seeking to improve both participation rates and the Irish talent identification system in youth soccer.

First, the competitive structure in which talent is nurtured in Ireland facilitates the pursuit of immediate rewards as competitions model themselves closely on the format of adult professional leagues. Dual fixtures and league formats allow a competitive mentality to permeate youth soccer as teams, by virtue of a league table, are geared solely toward prize winning. The competitive league structure for young children should be altered to remove a league table format that intensifies competition. Shifting to a format where individual match outcomes do not influence subsequent ties could serve to diminish the intensity of competitiveness at a youth level without shifting to a non-competitive match format.

Second, a reconsideration of the chronological age bands could lessen RAE. Iterating cut-off dates or establishing bi-annual age categories could reduce the observed bias. These modifications could reduce the range of ages within a particular band. Segregating players to a greater extent would encourage greater practice hours and playing time. Third, mentoring practices can be improved, especially those relating to a child's uptake of soccer. This will allow mentors to take an important step from understanding RAE to prevention.

A fourth mechanism to reduce RAE in Ireland concerns changing the playing environments. Competitive matches for organised soccer are commonly conducted within a full playing pitch.[4] These dimensions are conducive to utilising physique. Adjusting the playing environments can foster talent through rules that reduce the excessive advantages of physical attributes and promote skill and technique. An example of such an adjustment would be to set national guidelines that regulate the playing area and goal dimensions in tandem with age categories. While it may appear difficult to change existing mentalities regarding talent identification, adapting playing environments could negate the incentive and effectiveness of selecting a youth player primarily upon physical maturity.

[4] Standard field dimensions, established by the International Federation of Association Football (FIFA), impose a minimum pitch length of 90 metres and minimum width of 45 metres as a requirement for adult matches.

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