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A Lasting Legacy? The Persistence of Season of Birth Effects

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Abstract

Previous research has identified significant differences in the academic performance of children born at different times of year. In the USA, studies indicate that season of birth effects are strongest when children start school, but reduce markedly in the early stages of elementary school. Research in this country has found season of birth effects in both younger and older age-groups, but it is difficult to assess how these effects change as children grow older.

This study used reading test data from three cohorts of children in one LEA to investigate the persistence of season of birth effects between the ages of six and 12. Children born in the summer did significantly less well than children born in the autumn within all the age-groups. There was a steep reduction in the magnitude of season of birth effects between the ages of six and eight, little change between eight and ten, and a substantial decrease between the ages of ten and 12. Season of birth effects were found to be educationally significant at ages six, eight and ten, but not at age 12. One possible explanation for this is that the transfer from primary to secondary schools provides a fresh start and offers summer-borns an opportunity to catch up with their older peers.

1. Background

There is a growing body of evidence to show that season of birth affects school attainment. Children who are the youngest in the age group (those with summer birthdays) tend to perform less well at school, and are more likely to be referred for special educational needs (see Sharp and Benefield, 1995 for a summary of research in this field). Interestingly, the phenomenon is not confined to academic achievement: it has also been observed in success in football, with those born between September and December being substantially more likely to play the game professionally (Dudink, 1994).

There is some discussion about the extent to which early age-related differences in attainment persist. Studies in this country have found significant season of birth effects in samples of primary school children at age seven (e.g. Sharp and Hutchison, 1997; Sharp *et al.*, 1994; Shorrocks, 1993), and eleven (e.g. Fogelman and Gorbach, 1978; Mortimore *et al.*, 1988). There are also studies showing significant season of birth effects among secondary students, aged 13 and 15 (Bell and Daniels, 1990; Foxman *et al.*, 1990), and 16 (Alton and Massey, 1998; Massey *et al.*, 1996). Research into season of birth effects in post-compulsory education is limited. However, two studies suggest that there may be a ‘selection effect’ whereby fewer summer-borns enter for A-level (Alton and Massey, 1998) or go on to enter higher education (Russell and Startup, 1986).

In the USA, results from longitudinal studies have found that although there are significant age-related differences in the early stages of schooling, these tend to reduce markedly as children progress. Shepard and Smith (1986) suggested that effects in favour of older children have largely disappeared by the third grade (around the age of eight). More recently, Crosser (1998) reviewed the available evidence on the disadvantages of being summer-born and concluded that: ‘In general, studies indicate that the youngest children may score below the oldest children in a class, but any differences tend to be small and may be transitory’ (Crosser, 1998, p2). Nevertheless, findings that summer-born children do less well in the initial stages of schooling have led some US parents to ‘hold back’ their children from starting school. In contrast to the situation in this country, where almost all children are educated within their expected age-group, there is more flexibility in the year-group composition in other countries. The held-back US children begin school a year later and become the oldest in the class. The advisability and implications of this so-called ‘academic red-shirting’ have been a matter for considerable debate (Crosser, 1998; Meisels, 1992; Smith and Shepard, 1987).

We do not propose to rehearse in depth the question of why season of birth effects arise. However Sharp *et al.* (1994) have suggested that this may be due, in part, to the effect on a child of being the youngest in the class. Even if there is only one intake date in the year, so that summer-born children have the same amount of schooling as the rest of the class, their self-esteem may be affected by being younger and apparently less able than their older peers. The comparatively early school starting age in this country and the use of non-age adjusted testing, together with ability grouping practices, could also serve to perpetuate age-related differences beyond the early years (Harlen and Malcolm, 1997; Sharp, 1995 and 1998; Sukhnandan with Lee, 1998).

Although significant season of birth effects have been found among both primary and secondary pupils in this country, no UK studies were located that shed light on the relative impact of these effects as children grow older. It is possible that significant results in older age-groups may indicate relatively small differences observed in large samples. This issue forms the basis for the current enquiry.

2. The sample

This study examined reading test data collected by a medium-sized outer London authority. All but one of the LEA's 60 schools participated. The Suffolk Reading Test (Hagley, 1987) was administered to all children in three age-groups in the summer term of 1988. These cohorts are described as six-year-olds, eight-year-olds and ten-year-olds¹. The same children were tested again, using the relevant section of the same test two years later. (See Hutchison, 1993 and 1999 for more details of the sample.)

Pupils' 1988 scores were supplied from the school records at the same time as 1990 scores were collected. The age of each pupil was also recorded. For the purposes of this study, pupils were grouped into three seasons of birth in relation to the school year: autumn-born (September to December birthdates), spring-born (January to April) and summer-born (May to August). Those whose date of birth identified them as being older or younger than the normal age for the year group, or whose birth date was missing, were excluded from the analysis.

Table 2.1 shows the number of pupils in each cohort, and the subsample used for analysis (i.e. those with reading test data in both 1988 and 1990, dates of birth, and who were within the normal age range for their year group).

Table 2.1 The sample

| Age in 1988 | All Pupils | Sample with full data |
|-------------------------------|------------|-----------------------|
| Cohort 1 (six-year-olds) | 2568 | 2111 |
| Cohort 2 (eight-year-olds) | 2419 | 2031 |
| Cohort 3 (ten-year-olds) | 2272 | 1436 |
| Total | 7259 | 5578 |

Table 2.1 shows that information was collected on over seven thousand pupils: an average of 41 pupils per year-group for each of the participating schools. The majority of these pupils (77 per cent) had assessment results for both years, together with birthdate information that showed them to be within their expected year group. (The possible implications of excluding pupils without full data are considered in the Appendix to this

paper.) This sample provided an opportunity to consider changes in the relative performance of the same group of children at two points in time.

The table shows that a higher proportion of pupils were 'lost' from Cohort 3 than is true for the other two cohorts. This is probably due to the fact that these pupils had transferred between primary and secondary schools between the two assessment occasions, and their secondary schools did not have a record of the pupils' previous reading test results.

The distribution across the three 'seasons' of birth showed that there were slightly fewer autumn-borns (31 per cent) than either spring- or summer-borns (34 per cent and 35 per cent respectively). There were roughly equal proportions of boys and girls within each season of birth (ranging from 46 to 52 per cent of boys within each season across the three cohorts)².

3. Analysis

Schools were asked to record both raw and age-standardised scores for all pupils. However, age-standardised scores were of more value to the schools, so not all of them recorded the pupils' raw scores. This particularly affected data for the oldest children (Cohort 3). Since the focus of this study is on actual performance, rather than on performance taking age into account, the raw scores were utilised. Where raw scores were not available, these were imputed from the age-standardised scores and pupil birthdates (most of the scores for Cohort 3 in 1988 were imputed in this way).

The difference was calculated between the mean scores obtained by summer- and autumn-born pupils. This formed a basis for an examination of the differences between older and younger pupils in each year-group at two points in time. However, because different versions of the test were administered at different ages, raw scores are not directly comparable between children in different year-groups. This problem was addressed by dividing the mean scores for summer- and autumn-borns by the standard deviation for the whole year-group in order to provide effect sizes (Glass *et al.*, 1981).

The magnitude of effect sizes can be used to assess the educational significance of differences between groups. Cohen (1969) suggested that an effect size of between 0.2 and 0.5 can be described as a 'small effect'. More recently, 0.25 has been put forward as the threshold at which results can be considered to have an educational impact (Gray *et al.*, 1990; Slavin and Fashola, 1998).

4. Results

Table 4.1 compares the difference in mean reading scores between summer-borns and autumn-borns at the ages of six and eight, eight and ten, and ten and 12. For each cohort, a t-test was used to indicate whether the differences between the reading test scores for children born at different times of year remained constant or changed significantly between 1988 and 1990.

Table 4.1: Comparisons in reading test scores for children born at different times of year

| Cohort | Year | Age | Δ | SD | Effect size Δ/SD | Δ (ES) | N |
|--------|------|-----|----------|-------|----------------------------|---------------|------|
| 1 | 1988 | 6 | -6.13 | 12.92 | -0.47 | 0.19*** | 2111 |
| | 1990 | 8 | -3.12 | 10.81 | -0.29 | | |
| 2 | 1988 | 8 | -3.69 | 10.66 | -0.35 | 0.03(NS) | 2031 |
| | 1990 | 10 | -3.22 | 10.20 | -0.32 | | |
| 3 | 1988 | 10 | -2.82 | 9.34 | -0.30 | 0.14** | 1436 |
| | 1990 | 12 | -1.45 | 9.03 | -0.16 | | |

Notes: Δ is the difference in mean scores between summer-borns and autumn-borns.
Effect size (ES) = Δ/SD

The table shows that autumn-born pupils obtained better results than their summer-born peers within all three cohorts. (This is indicated by the negative values for all means and effect sizes.) The magnitude of the difference appears to be related to age. Effect sizes vary from a rather substantial -0.47 among six-year-olds to a much smaller -0.16 at age 12. Taking 0.25 as the threshold for educational significance, the effect sizes indicate that all differences are educationally significant, with the exception of the last (the 12-year-olds).

The effects within each cohort are of particular interest, because these groups consist of the same children on two occasions. The youngest group shows a substantial decrease in effect size between the ages of six and eight, indicating that the gap between summer- and autumn-borns, although still apparent, was significantly reduced on the second occasion of testing ($p < .001$). In Cohort 2, which contains children tested at ages eight and ten, the difference between autumn- and summer-borns is educationally significant, and there is no significant change in the difference in age-related scores obtained in the two years. In Cohort 3, there is a statistically significant reduction ($p < .01$) in the season of birth effect for children tested at the ages of ten and 12. The effect size indicates that summer-borns did significantly less well than autumn-borns at age ten, but that the difference was no longer educationally significant at age 12.

5. Discussion

This study has added to the body of research into age effects. It found that autumn-born pupils in a year group performed substantially better in reading than their summer-born classmates throughout the primary school.

One would expect that younger children in a year group might well be at a disadvantage in the early years of schooling, because small age differences represent a relatively large proportion of a young child's life. To what extent, however, does this persist as pupils

grow up? Have age-related differences effectively died away by the time children reach the age of eight, as is the case in the USA (Shepard and Smith, 1986; Crosser, 1998)? This study is able to address these questions because it used a similar test for children aged between six and 12.

The study found that the 'season of birth effect' reduces from what can only be described as large in an educational context (half a standard deviation) at age six, to about a third of this at age 12. It is interesting to note the way in which these seasonal differences reduce in size between the two occasions on which the test was administered. If asked to predict the pattern of age-related effects, it would be logical to assume that seasonal differences would decrease most rapidly in the early years of primary school because children are developing rapidly, and the relative difference in age reduces as children grow older. Thereafter, one would expect the season of birth effect to continue to reduce at a steady, though decreasing rate until it is no longer apparent among older primary children.

As predicted, the results of this study show the largest difference in the youngest age-group (six-year-olds) and there is a sharp drop in the magnitude of season of birth effects between the ages of six and eight. However, the persistence of age effects among eight- and ten-year-olds, followed by a further sharp drop between the ages of ten and 12, is somewhat surprising.

A possible explanation of this pattern of results is provided below. It seems to be compatible with a mechanism whereby children's academic status in class is largely established in the lower part of primary school, and is maintained by classroom dynamics (such as teacher and peer expectations, academic self-image) as long as the pupils remain within the same milieu. The use of non-age adjusted tests may also serve to perpetuate age-related expectations. When pupils move on to the larger horizons of secondary school with new friends, new subjects and new teachers, these expectations may be open to re-negotiation. It could be that secondary schools provide a 'fresh start', enabling the younger children in a year group to catch up with their older peers.

The persistence of season of birth effects among older primary school pupils is a matter of interest, if not a cause for concern. This warrants further research, to ascertain whether these effects can be found more widely, and if so, to consider how best to address the educational disadvantages faced by children born at the 'wrong time of year'.

Appendix: the effect of non-response

As noted in the body of the paper, the data for 1988 is incomplete. This led to a reduction in sample size when analyses were restricted to pupils with full data in both 1998 and 1990. How much effect did this have on the results of the analyses? In order to investigate this, we considered the effect of restricting analyses involving the 1990 scores to pupils for whom we had 1988 scores. The results of this are shown in Table A1.

Table A1: Effect of sample restriction on the size of observed season of birth effects

| Cohort | | 1990 analysis sample | Reduced sample (those with 1988 scores) |
|---------------|-------------|----------------------|---|
| 1 (Age 6) | Δ | -3.36 | -3.20 |
| | Popn. SD | 11.26 | 10.88 |
| | Effect size | -0.30 | -0.29 |
| | N | 2504 | 2111 |
| 2 (Age 8) | Δ | -3.46 | -3.27 |
| | Popn. SD | 10.49 | 10.28 |
| | Effect size | -0.33 | -0.32 |
| | N | 2327 | 2031 |
| 3 (Age 10) | Δ | -1.71 | -1.59 |
| | Popn. SD | 9.96 | 9.06 |
| | Effect size | -0.17 | -0.18 |
| | N | 2050 | 1436 |

Note: Δ is the difference in mean scores between summer-borns and autumn-borns.
Effect size = Δ /SD

The table shows how the difference between the two extreme groups, summer-borns and autumn-borns, is affected by the restriction of the 1990 analysis sample to those with 1988 scores. The importance of any differences depends to some extent on the size of the actual effects being investigated, but if the results under investigation are of the order of 0.01 in terms of effect size, as here, then non-response biases may be considered of relatively minor importance.

References

- ALTON, A. and MASSEY, A. (1998). 'Date of birth and achievement in GCSE and GCE A-level', *Educational Research*, **40**, 1, 105-9.
- BELL, J.F. and DANIELS, S. (1990). 'Are summer-born children disadvantaged?: the birthdate effect in education', *Oxford Review of Education*, **16**, 1, 67-80.
- COHEN, J. (1969). *Statistical Power Analysis for Behavioral Sciences*. New York, NY: Academic Press.

- DUDINK, A. (1994). 'Birth date and sporting success', *Nature*, **368**, 14 April, 592.
- CROSSER, S. (1998). *He Has a Summer Birthday: the Kindergarten Entrance Age Dilemma* (ERIC Digest EDO-PS-98-7). Champaign, IL: University of Illinois at Urbana – Champaign, Children's Research Center.
- FOGELMAN, K. and GORBACH, P. (1978). 'Age of starting school and attainment at 11', *Educational Research*, **21**, 1, 65-6.
- FOXMAN, D., RUDDOCK, G. and McCALLUM, I. (1990). *APU Mathematics Monitoring 1984-88 (Phase 2): a Summary of Findings, Conclusions and Implications* (Assessment Matters: No. 3). London: SEAC.
- GLASS, G.V., McGAW, B and SMITH, M.L. (1981). *Meta-Analysis in Social Research*. Thousand Oaks, CA: Sage.
- GRAY, J., JESSON, D. and SIME, N. (1990). 'Estimating differences in the examination performances of secondary schools in six LEAs: a multi-level approach to school effectiveness', *Oxford Review of Education*, **16**, 2, 137-58.
- HAGLEY, F. (1987). *Suffolk Reading Scale: Teacher's Guide*. Windsor: NFER-NELSON.
- HARLEN, W. and MALCOLM, H. (1997). *Setting and Streaming: a Research Review* (Using Research Series 18). Edinburgh: SCRE.
- HUTCHISON, D. (1993). 'School effectiveness studies using administrative data', *Educational Research*, **35**, 1, 27-47.
- HUTCHISON, D. (1999). The effect of group-level influences on pupil progress in reading. Unpublished PhD thesis, University of London.
- MASSEY, A., ELLIOTT, G. and ROSS, E. (1996). 'Season of birth, sex and success in GCSE English, mathematics and science: some long-lasting effects from the early years?' *Research Papers in Education*, **11**, 2, 129-50.
- MEISELS, S.J. (1992). 'Doing harm by doing good: iatrogenic effects of early childhood enrollment and promotion policies', *Early Childhood Research Quarterly*, **7**, 2, 155-74.
- MORTIMORE, P., SAMMONS, P., STOLL, L., LEWIS, D. and ECOB, R. (1988). *School Matters: the Junior Years*. Wells: Open Books.
- RUSSELL, R.J.H. and STARTUP, M.J. (1986). 'Month of birth and academic achievement', *Personality and Individual Differences*, **7**, 839-46.

SHARP, C. (1995). 'What's age got to do with it? A study of patterns of school entry and the impact of season of birth on school attainment', *Educational Research*, **37**, 3, 251-65.

SHARP, C. (1998). 'Age of starting school and the early years curriculum.' Paper presented at the NFER's Annual Conference, One Great George Street Conference Centre, London, 6 October.

SHARP, C. and BENEFIELD, P. (1995). *Research into Season of Birth and School Achievement: a Select Annotated Bibliography*. Slough: NFER.

SHARP, C and HUTCHISON, D. (1997). *How Do Season of Birth and Length of Schooling Affect Children's Attainment at Key Stage 1? A Question Revisited*. Slough: NFER.

SHARP, C., HUTCHISON, D. and WHETTON, C. (1994). 'How do season of birth and length of schooling affect children's attainment at key stage 1?' *Educational Research*, **36**, 2, 107-21.

SHEPARD, L.A. and SMITH, M.L. (1986). 'Synthesis of research on school readiness and kindergarten retention', *Educational Leadership*, **44**, 3, 78-86.

SHORROCKS, D. (1993) *Testing and Assessing 6 and 7 Year Olds: the Evaluation of the 1992 Key Stage 1 National Curriculum Assessment. Final Report*. London: NUT.

SLAVIN, R.E. and FASHOLA, O.S. (1998). *Show Me the Evidence! Proven and Promising Programs for America's Schools*. Thousand Oaks, CA: Corwin Press.

SMITH, M.L. and SHEPARD, L.A. (1987). 'What doesn't work: explaining policies of retention in the early grades', *Phi Delta Kappan*, **69**, 2, 129-34.

SUKHNANDAN, L. with LEE, B. (1998). *Streaming, Setting and Grouping by Ability: a Review of the Literature*. Slough: NFER.

¹ The description of pupils ages (six-, eight- and ten-year-olds) refers to the pupils' age at the start of the 1988 school year. As the testing took place during the summer term, a substantial proportion of these pupils would actually be seven, nine, or 11, respectively, at the time of testing.

² The differences in distribution of boys and girls across the three seasons of birth were investigated, to consider their impact on the pattern of results in the reading test. The impact was found to be relatively small, and could not account for differences in scores achieved by summer- and autumn-borns.