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CLASS SIZE AND PUPIL-TEACHER RATIO: POLICY AND PROGRESS

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Government policy relating to reduction in class size and pupil-teacher ratio over the past 50 years is outlined. Since the 1980s, the policy has focused on positive discrimination towards schools serving pupils in disadvantaged areas. An examination of statistics reveals a decline in overall pupil-teacher ratio from 32.4:1 to 16.6:1 over the period 1967/68 to 2005/06. Statistics for single-grade class size for the period 1985/86 to 2005/06 also show a decline, more so in junior than in senior classes. Time-series analyses indicate that the introduction of schemes involving reduction in class size to address disadvantage was associated with a perceptible departure from overall trends. Class size in the urban dimension of Giving Children an Even Break (GCEB) was found to be smaller than class size in other urban schools.

The issue of class size in primary schools consistently generates interest among educationists, parents, teachers, and the media in general. In recent years, public interest has been heightened by the periodic publication of international statistics relating to the issue. For example, the publication of comparative international data by the OECD on a variety of educational issues, including class size, invariably leads to widespread comment (see, e.g., OECD, 2006). Frequently, the commentary reflects the perception that Ireland compares unfavourably with other countries.

Media interest in the topic is by no means a recent phenomenon. A search of the archives of *The Irish Times* found a total of 1,147 articles and editorials addressing or mentioning the issue between 1955 and 2005[1]. One article, published in 1961, entitled 'Revision of teacher-pupil ratio sought: I.N.T.O. urges smaller classes' called for 'revision of the pupil-teacher ratio to ensure that no teacher will have more than 30 pupils in a class or group'. The title of this article serves to highlight the tendency for the terms 'class size' and 'pupil-teacher ratio' to be confounded. It is, therefore, important to

[1] While a search of *The Irish Times* archives for 'class size' between 1955 and 2005 revealed that 312 articles dealing with the issue were published, a search for 'pupil-teacher ratio' identified 835 articles. On closer examination, the emphasis of many of the latter was actually on class size.

note that the former refers to the number of pupils regularly in a teacher's classroom, while the latter is simply the ratio of pupils to the total number of full-time teachers. This means that class size is more likely than pupil-teacher ratio to describe the everyday setting in which a pupil is taught, while pupil-teacher ratio provides an index of the level of professional support available to pupils.

In this paper, we review government policy relating to pupil-teacher ratio and class size in primary schools over the past half century as expressed in policy and initiatives, green and white papers, and programmes for government. Statistics for pupil-teacher ratio (from 1967/68 to 2004/05) and for class size (1985/86 to 2005/06) are presented. A series of analyses will examine reductions in class size and pupil-teacher ratio in schools participating in schemes to address disadvantage.

GOVERNMENT POLICY ON CLASS SIZE AND PUPIL-TEACHER RATIO AT PRIMARY LEVEL

Over the last half-century or so, the issue of class size has been a regular feature on the educational agenda, and reducing it has been an element of government policy. O'Connor (1986) described how, in the 1930s, it was not uncommon for classes in the Dublin area to contain 50 pupils or more. Two factors (in addition, presumably, to a lack of finance) made change in this area difficult. The first was a shortage of teachers due, in part, to the 'marriage ban' (an employment law in place from 1934 to 1958 which prevented married women from becoming teachers or remaining in teaching posts once they got married). The second was the nature of the regulations governing the appointment of additional teachers. For example, a school could not appoint a third teacher until total enrolment reached 100. Following his appointment as Minister for Education in 1957, Jack Lynch facilitated reductions in class size by removing the marriage ban and reducing the enrolment requirements for the appointment of additional teachers. An interest in class size was shared by his successor, Patrick Hillery, who in 1964 dispatched inspectors to all national schools in Dublin to investigate class size. The finding that over 700 classes had more than 50 pupils led to an instruction to Inspectors to ensure that no class in any school exceeded this number. It was envisaged that this would be achieved by various means, including rearranging classes or classrooms, appointing additional teachers, and providing additional prefabricated accommodation. Meanwhile, the *Investment in Education* (1965) report confirmed that small improvements in

the pupil-teacher ratio had occurred between 1959 and 1963, but concluded that the numbers required for the appointment of additional teachers remained excessive. For example, a school could appoint a second teacher when enrolment reached 36, but a third could not be appointed until numbers reached 90, and a fourth until numbers reached 140. In practice, these requirements discriminated against larger schools, which tended to have higher pupil-teacher ratios.

While Donogh O'Malley mentioned the issue of class size in his Estimates of Expenditure speech for 1966/67, there followed a period in which concern with the issue of class size appeared to diminish until it re-emerged as a topic for discussion, albeit not a prominent one, in the *White Paper on Educational Development* (1980). The paper noted that small classes were a positive feature of special schools and that the reduction in the pupil-teacher ratio in previous years had helped ordinary schools to provide an appropriate educational service for pupils with learning disabilities. It challenged the common conception that small class size is necessary for effective education, stating that 'most of the studies carried out here and in other countries do not support the general belief that class size is a major factor in pupil performance' (p. 37), while acknowledging the importance of the pupil-teacher relationship in the educational process. It also pointed out that, in the years preceding the paper's publication, the government had investigated instances of overlarge classes and had attempted to remedy the situation through class reorganization in affected schools. The paper also introduced the concepts of positive discrimination and targeting of educationally disadvantaged pupils, a theme which was to feature much more strongly in the green paper on education (*Education for a Changing World,* 1992) published twelve years later.

The green paper (*Education for a Changing World*, 1992), in the context of a discussion setting out as a priority the establishment of equity in the education system, cited an OECD review which advised that additional teaching posts should be assigned to areas in which educationally disadvantaged schools and pupils were located. It also referred to the agreement reached under the Programme for Economic and Social Progress (1991) concerning the allocation of posts to pupils with special needs, such as the provision of remedial teachers and additional posts to schools in disadvantaged areas. An objective to lower the overall pupil-teacher ratio was also mentioned. The white paper on education (*Charting our Education Future*, 1995) which followed did not articulate any policy developments on

class size, but noted that the pupil-teacher ratio had decreased significantly since 1965/66.

The class size issue has featured more recently in agreed Programmes for Government. In the 2002 Programme, for example, it was stated that 'We will continue to reduce the pupil: teacher ratio in our schools. Over the next five years we will progressively introduce maximum class size guidelines which will ensure that the average size of classes for children under 9 will be below the international best-practice guideline of 20:1.' (*An Agreed Programme for Government*, 2002, p. 23). The 2007 Programme for Government promised to 'increase the number of primary teachers by at least 4,000. This will enable us to reduce class sizes. The staffing schedule will be reduced from a general rule of at least one teacher for every 27 pupils in 2007/08, by one point a year, to one for every 24 children by 2010/11' (*An Agreed Programme for Government*, 2007, p. 40).

While earlier government policy had been to bring about overall reductions in class size, the 1980s saw the emergence of an emphasis on using class size measures to positively discriminate in provision for pupils in disadvantaged areas. This was reflected in a variety of initiatives, all of which contained some element which impacted on class size. The first involved the appointment of concessionary teaching posts in the 1980s to schools identified as serving disadvantaged areas and the prioritization of these schools for the allocation of remedial teachers. The *Programme for Action in Education* (1984) noted that while the (overall) pupil-teacher ratio compared unfavourably with that in other developed countries, an undertaking was given to improve the position when financial circumstances permitted. However, it also stated that, in the meantime 'further posts will be generated for special service in National Schools in line with the policy to give priority to the disadvantaged' (p. 16).

In the 1990s, a more formal version of the scheme involving the allocation of concessionary posts was established, which would later become known as the Disadvantaged Areas Scheme (DAS). A review undertaken in 1995 of provision for disadvantaged pupils in general, and of the DAS in particular, led to the formulation of several recommendations for future identification and targeting of educationally disadvantaged pupils (Kellaghan, Weir, Ó hUallacháin, & Morgan, 1995). While the proposed approach was multi-faceted in addressing the needs of educationally disadvantaged children, it included the specific recommendations that provision should be targeted at a limited number of schools with high concentrations of pupils

from disadvantaged backgrounds, and that the size of junior classes in these schools should be reduced to facilitate individual attention to pupils and the development of teacher-pupil relationships. In line with these recommendations, the Breaking the Cycle Scheme (BTC) was introduced in 1996/97 on a pilot basis in selected urban and rural schools. A key provision of the urban dimension of the scheme was the reduction in size of junior classes (junior infants to second class) to about 15 in participating schools.

The introduction of Giving Children an Even Break (GCEB) in 2000 continued the policy of positive discrimination towards schools serving pupils from disadvantaged backgrounds. One of the main provisions of the scheme for urban schools identified as having high concentrations of pupils from disadvantaged backgrounds (i.e., those above the 'post-bar', the point in the rank order above which teaching posts were allocated) was the allocation of additional teaching staff to permit the operation of junior classes with 20 or fewer pupils (junior infants through second classes) and senior classes with 27 or fewer pupils (third through sixth classes)[2]. The most recent initiative involving positive discrimination towards disadvantaged pupils was introduced in 2005. Delivering Equality of Opportunity in Schools (DEIS) provides for maximum class sizes in urban primary schools with the highest levels of disadvantage of 20 in junior and 24 in senior classes, alongside a range of other supports (Department of Education and Science, 2005b).

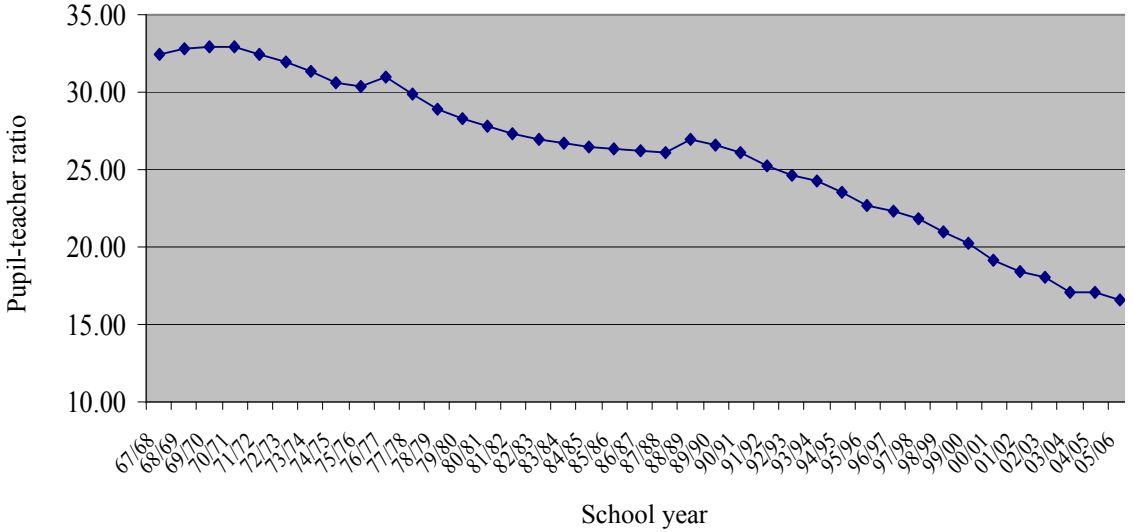
PUPIL-TEACHER RATIO IN PRIMARY SCHOOLS, 1967/68 TO 2004/05

Our first set of analyses relates to the overall pupil-teacher ratio in Irish primary schools over the period 1967/68 to 2005/06. The relevant figures (i.e., the total enrolment in all national schools divided by the total number of teaching posts) were extracted from Department of Education and Science (1967-2006) annual statistical reports for each year in question. As Figure 1 shows, there was a decline in the pupil-teacher ratio from 32.4:1 in 1967/68 (when the relevant data were first published) to 16.6:1 in 2005/06.

While the decline reflects reductions in class size, it also reflects teaching appointments that do not impact directly on class size, such as those involving the appointment of administrative principals and learning support

[2] When GCEB was introduced, the maximum class size at senior level was set at 29 for schools above the post-bar. In 2002, the DES further reduced the class size maximum to 27.

Figure 1
Pupil-Teacher Ratio in Primary Schools, 1967/68 to 2005/06



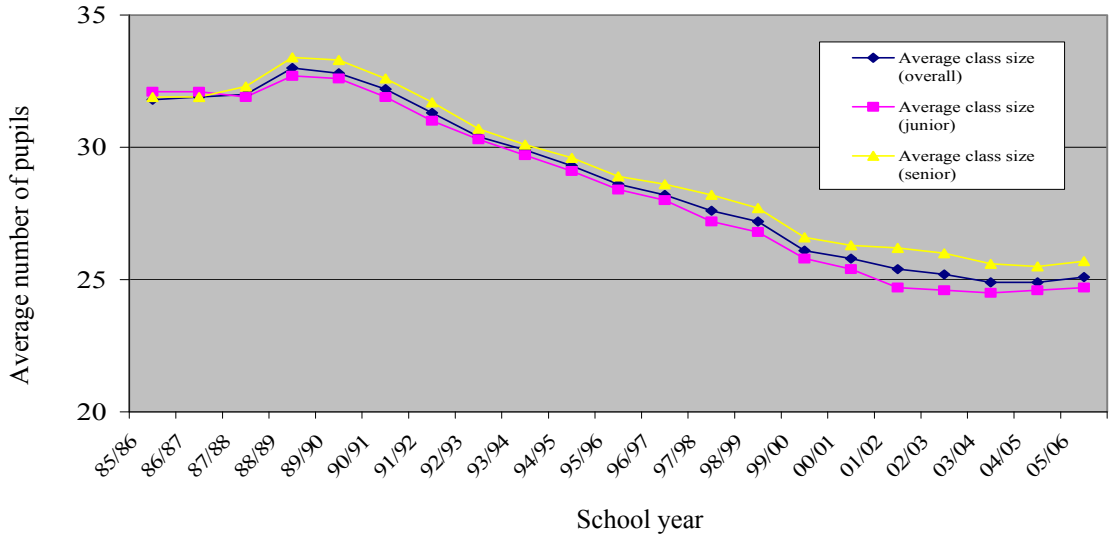
teachers. The gap between pupil-teacher ratio and average class size has widened considerably over recent years with an increase in the appointment of teachers not assigned to particular classes. Many of these teachers were responsible for children with special education needs in mainstream primary schools (Department of Education and Science, n.d.). In 1998, the number of such resource teachers was 212 (Department of Education and Science, n.d.). By 2004, the number had risen to 2,600 (Department of Education and Science, 2005a). For example, in all 3,186 ordinary national schools in 1997/98, there were 657 administrative principals and 1,590 other full-time teachers (apart from 'teaching' or ordinary class teachers), giving a pupil-teacher ratio of 23:1. By 2004/05, there were 952 administrative principals and 4,565 other full-time teachers (apart from ordinary class teachers) giving a pupil-teacher ratio of 18:1 (Department of Education and Science annual statistical reports for relevant years). The decrease in average class size, however, was much smaller. In 1997/98, average class size was 26.1 (i.e., 446,359 ordinary class pupils divided by 17,123 ordinary class teachers). In 2004/05, it was 24.3.

CLASS SIZE IN PRIMARY SCHOOLS, 1985/86 TO 2005/06

In addition to the appointment of teachers without normal classroom teaching duties, pupil-teacher ratios described in the proceeding sections have also been affected by rationalization (e.g., amalgamations and closures) taking place in the system generally. Such rationalization may, for example, have led to small rural schools experiencing a deterioration in pupil-teacher ratio while retaining relatively small class sizes. For this reason, it may be more meaningful to examine data on class size as it relates to single-grade classes. Data which allow an average class size figure to be computed for single-grade, consecutive, and multi-grade classes have been published by the Department on an annual basis since 1985/86.

Trends in average class size are presented in Figure 2 for the period 1985/86 to 2005/06 separately for junior classes (up to and including second class), senior classes, and overall. The three plots exhibit similar features: a fairly large decline over the 20-year period, an untypical increase in 1988/89, and a levelling off of the downward trend in the last three years of the period. For example, the overall average size of single-grade classes fell from 31.8 in 1985/86 to 25.1 in 2005/06. There was a slight increase in 1987/88 and a

Figure 2
Average Class Size Overall and at Junior and Senior Level, 1985/86 to 2005/06



larger one in 1988/89 to 33.0. From that point onward the downward trend in class size continued in each successive year until 2003/04 and 2004/05 when it remained static. In the following year (2005/06), the average size of single-grade classes increased marginally from 24.9 to 25.1. Apart from the increase in 1988/89, the graph seems to depict a smooth trend. In light of analysis to be presented later, it is important to note the way in which the plots for junior and senior classes diverge over the 20 years. At the start of the period, the two averages were almost identical (32.1 for junior classes and 31.9 for senior classes) but, by 2005/06, the average for junior classes (24.7) was 1.5 points lower than the average for senior classes (26.2).

Figures 3 and 4, showing the percentages of children in junior classes with fewer than 20 and more than 30 pupils respectively, reflect the same basic pattern as Figure 2. However, Figure 3 seems to show a more pronounced increase in the percentage of junior pupils in classes of fewer than 20 pupils in 1997/98 and 2001/02, while Figure 4 shows an increase in the percentage of junior pupils in classes of 30 or more in 1988/89 and a decrease in that percentage in 1999/2000. Because these apparent distortions to the trend in Figures 3 and 4 happen to coincide with the introduction of BTC and GCEB, introduced respectively in 1997 and 2001, an interrupted time series analysis (see Chatfield, 2004) with Auto-Regressive Integrated Moving Average (ARIMA) modelling was used (a) to confirm the existence of an underlying trend and (b) to establish whether the changes noted corresponding to the introduction of BTC and GCEB represent statistically significant departures from any such trend. The modelling exercise was done for average class size (i.e., with the data represented in Figure 2) as well as for the percentage of pupils in classes with fewer than 20 and more than 30 pupils (Figures 3 and 4). The ARIMA models used in analyses are described in an Appendix.

Not surprisingly, the existence of a trend was confirmed in all three cases. However, statistically significant departures from that trend observed in the years in which BTC and GCEB were introduced were found only in analyses of percentages of pupils in classes with fewer than 20 pupils. The probability that the increase in the percentage of pupils in classes with fewer than 20 could have occurred by chance following the introduction of BTC was about one in a thousand, while the corresponding probability for GCEB was even less (i.e., p-values were less than or equal to .001). In contrast, when average class size and the percentage in classes of more than 30 were analysed, p-values were well above .05.

Figure 3
Percentage of Junior Pupils in Classes with less than 20 pupils, 1974/75 to 2005/06

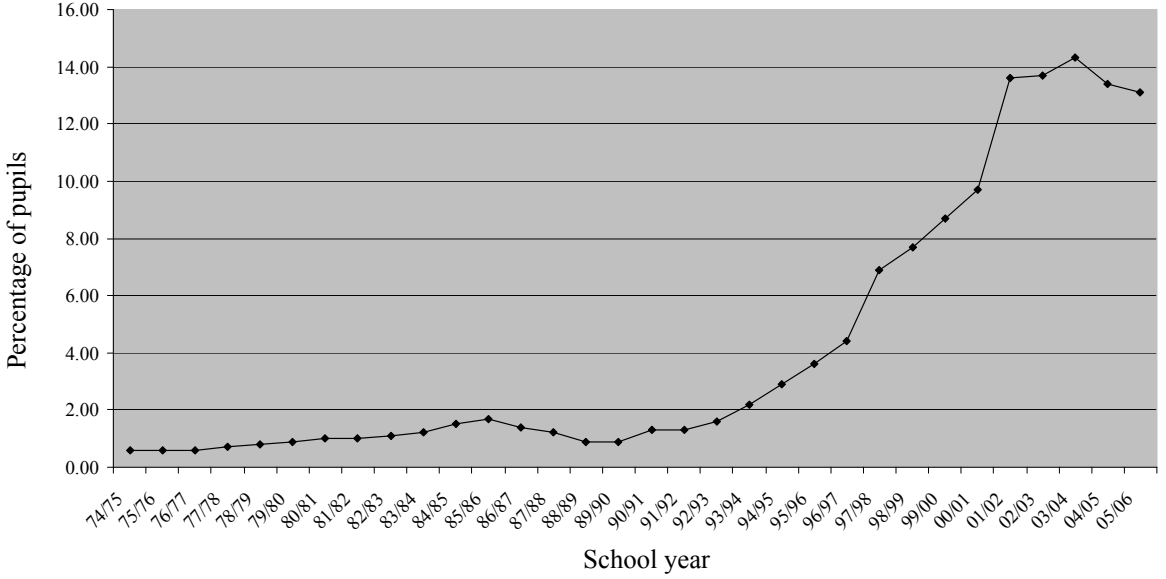
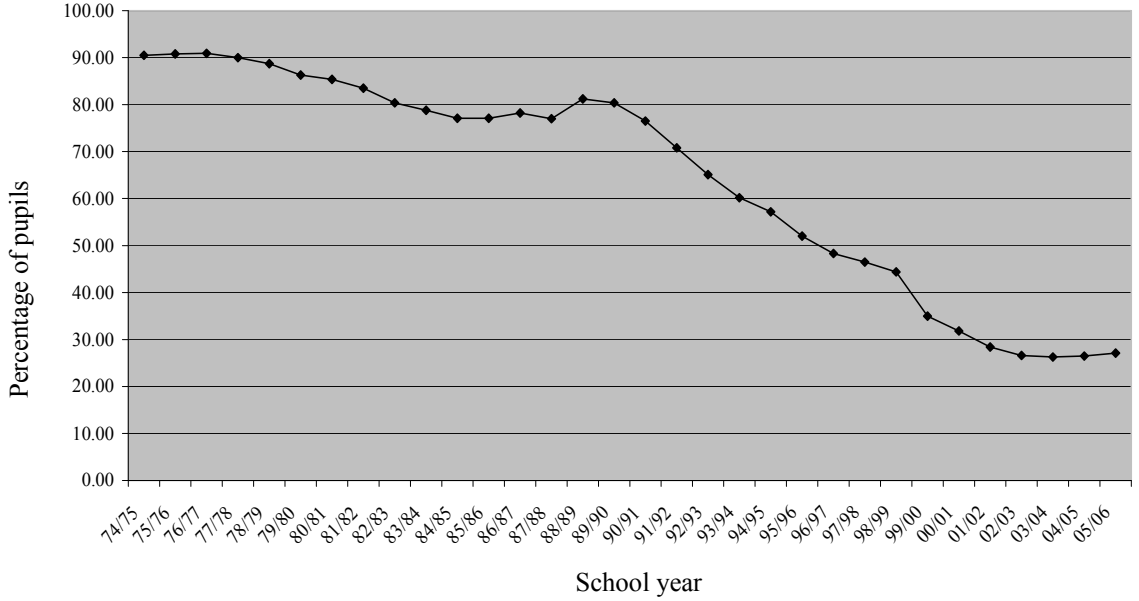


Figure 4
Percentage of Junior Pupils in Classes with 30 or more Pupils, 1974/75 to 2005/06



To summarize, the data in Figures 1 to 4 suggest two things. First, efforts to reduce class size and pupil-teacher ratio in line with government objectives were successful up to 2005/06. Second, there is evidence of positive discrimination towards schools serving disadvantaged pupils in the outcome of trend analyses which suggests that the introduction of BTC and GCEB had an identifiable and significant effect on the percentage of junior classes containing fewer than 20 pupils. However, the role of coincidence cannot be ruled out, and it is possible that the observed discontinuities are the result of something other than the introduction of these schemes. In the next section, we will use data on the size of individual classes in the school year 2004/05 provided by the Department of Education and Science (a) to examine the extent to which the larger of these two schemes – GCEB – resulted in the planned-for reductions in class size at junior level, and (b) to compare class sizes in GCEB and other schemes for disadvantage with class sizes in schools not participating in such schemes in an attempt to assess the level of positive discrimination in schools with high concentrations of disadvantage.

CLASS SIZE IN JUNIOR CLASSES IN GIVING CHILDREN AN EVEN BREAK

The Giving Children an Even Break (GCEB) scheme (introduced in 2001) set out to provide additional resources to primary schools serving pupils from disadvantaged backgrounds[3]. In this section we use data provided by the Department of Education and Science (DES) on class sizes in all primary schools in the state in 2004/2005 to assess the extent to which class size reductions as envisaged for schools in GCEB had been implemented. It should be noted that the data on class size provided by the DES were for all *classes* in the system (*N*=17,967), rather than for all schools (*N*=3,155). However, the school roll number associated with each class permitted classes to be categorized according to their participation in schemes such as GCEB and DAS.

[3] The GCEB scheme represented the latest in a series of initiatives for disadvantage which included the DAS and BTC. The 238 urban schools in GCEB identified as having the greatest concentration of disadvantaged pupils were entitled to appoint additional staff to operate a class size maximum of 20 at junior level (Junior Infants to second class). The DAS was introduced in a small number of primary schools in 1984 and grew to over 300 schools in 1999. BTC was introduced in 1996/97 to a subset of 32 urban primary schools in the DAS that were identified as serving concentrations of pupils from disadvantaged backgrounds. These schools were permitted to operate maximum class sizes of around 15 pupils at junior level.

Before proceeding with the examination of the impact of GCEB on class size, several issues merit attention. First, many schools that were above the post-bar in GCEB were already participating in other schemes which conferred a staffing advantage[4]. For this reason, comparative class size data for these subsets of schools sometimes feature in the analysis reported here. Second, the current analysis is confined to schools in urban areas as reduced class sizes were confined to schools in the urban dimension of GCEB. Third, the analysis of class size data is limited, for the purpose of this report, to single-grade classes. While most of the classes in the population of urban schools are single-grade, there is a sizeable minority of consecutive classes, and even a few multi-grade classes, in this population. Fourth, the focus of the analysis is on junior classes (i.e., Junior Infants to second class), as most of the additional staffing under the scheme was in these classes. Finally, the analysis is based on data on pupils in ordinary classes and excludes pupils from the Travelling Community and pupils with special needs, as these pupils were not counted when allocating teachers for GCEB[5].

From Table 1, it is clear that the majority (73.7%) of junior single-grade classes in GCEB schools are comprised of 20 or fewer pupils. This compares with 27% of classes nationally. Although more than a quarter of all GCEB junior classes have more than 20 pupils, most of these exceed 20 by only a few pupils (over 80% of these have between 21 and 24 pupils). There is also a tendency in GCEB classes for the percentage of classes of fewer than 20 to reduce with increasing grade level, a pattern also found for classes nationally. For example, in GCEB schools, 82.6% of Junior Infant classes have 20 or fewer pupils, compared to 63.1% of second classes. In schools nationally, the comparable percentages are 34.3% for Junior Infants and 22.3% for second class. This would seem to indicate that both GCEB schools and schools nationally prioritize the extreme junior end of the school when allocating teachers. It will be recalled from Figure 2 that the size of junior classes as a group is, on average, smaller than the size of senior classes. A tiny minority of GCEB schools (less than 1%) have junior classes that exceed 29 pupils. In schools nationally, however, one junior class in every five (20.1%) has more than 29 pupils. Overall, the data in Table 1 appear to show that the majority of pupils in GCEB schools are being taught in classes with 20 or fewer

[4] For an account of the overlap between schemes for disadvantage at school level, see Weir and Archer (2005).

[5] The fact that such pupils were not counted gave rise to some problems that are described by Weir (2004).

pupils, that Junior Infants appear to be prioritized in the allocation of teachers to reduce class size, and that schools in GCEB have much greater percentages of junior pupils in small classes than schools nationally.

Table 1
Number and Percentage of Single Grade Junior Classes Overall and by Grade Level in Urban GCEB Schools, and in Urban Schools Nationally, with 20 or Fewer Pupils, 21-29 Pupils, and More Than 29 Pupils.

	Number in class	All Junior Classes (*N*=1,276)	Junior Infants (*N*=345)	Senior Infants (*N*=331)	First Class (*N*=305)	Second Class (*N*=295)
GCEB urban schools	≤20	940 (73.7%)	285 (82.6%)	242 (73.1%)	227 (74.5%)	186 (63.1%)
	21-29	332 (25.9%)	59 (17.1%)	89 (26.9%)	76 (24.9%)	107 (36.3%)
	29+	5 (0.4%)	1 (0.3%)	0 (0%)	2 (0.7%)	2 (0.6%)
	Number in class	All Junior Classes (N=4,710)	Junior Infants (N=1,282)	Senior Infants (N=1,195)	First Class (N=1,141)	Second Class (N=1,092)
All urban schools	≤20	1,271 (27.0%)	440 (34.3%)	302 (25.3%)	285 (25.0%)	244 (22.3%)
	21-29	2,492 (52.9%)	646 (50.4%)	651 (54.5%)	607 (53.2%)	588 (53.8%)
	29+	947 (20.1%)	196 (15.3%)	242 (20.3%)	249 (21.8%)	260 (23.8%)

Table 1 contains some evidence of positive discrimination insofar as classes with 20 pupils or fewer are more common in GCEB (above post-bar) schools (73.7%) than in other schools (27%) when all junior classes are

considered. It is also worth noting from Table 1 that while 20.1% of junior classes in non-GCEB schools have 29 pupils or more, there are only five such classes (0.4%) in GCEB schools. Further evidence of positive discrimination is in Table 2, which shows average junior class sizes in schools that were above, and not above, the GCEB post-bar. The data in the table confirm that schools above the post-bar have much more favourable class sizes than schools not above the post-bar, and that schools (both above and not above the post-bar) prioritize junior classes in allocating teachers. On average, classes in schools that are not above the post-bar have about eight more pupils in Junior Infants and second class, and almost nine more in Senior Infants and first class, than classes above the post-bar.

Table 2
Average Number of Pupils in Single Grade, Urban, Junior Classes in Schools Above and Not Above the GCEB Post-bar

Class Type	All Junior Classes (N=4,168)	Junior Infants (N=1,133)	Senior Infants (N=1,059)	First Class (N=1,010)	Second Class (N=966)
Above post-bar	18.25 (N=1,276)	17.49 (N=345)	18.11 (N=331)	18.41 (N=305)	19.15 (N=295)
Not above post-bar	26.61 (N=3,434)	25.40 (N=937)	26.92 (N=864)	27.10 (N=836)	27.18 (N=797)

While the simple comparisons made possible by the data in Table 2 provide a useful starting point in assessing whether GCEB led to positive discrimination in participating schools in relation to class size, further, and more detailed, comparisons are necessary due to the complication already noted arising from schools' participation in other schemes. For example, most classes participating in BTC (urban) were also above the GCEB post-bar. However, their pre-existing, very small, junior class sizes (of about 15) are also reflected in the averages for schools above the post-bar. For this reason, the data in Table 3 were compiled to show average class sizes for various categories of school participating in a variety of schemes, including GCEB.

Table 3
Average Number of Pupils in Single Grade, Urban, Junior Classes, According to DAS, GCEB, and BTC Status

Class Type	All Junior Classes	Junior Infants	Senior Infants	First Class	Second Class
In GCEB and DAS	18.11 (N=1,073)	17.39 (N=288)	18.00 (N=278)	18.20 (N=258)	18.95 (N=249)
In GCEB only	19.03 (N=203)	18.00 (N=57)	18.64 (N=53)	19.55 (N=47)	20.22 (N=46)
In DAS only	23.24 (N=318)	21.45 (N=89)	23.94 (N=81)	24.08 (N=78)	23.79 (N=70)
Not in GCEB or DAS	26.98 (N=2,574)	25.78 (N=699)	27.28 (N=647)	27.39 (N=627)	27.63 (N=601)
In BTC, GCEB, and DAS	14.21 (N=170)	13.77 (N=47)	14.12 (N=43)	15.03 (N=40)	14.00 (N=40)
In GCEB, and DAS, but not in BTC	18.84 (N=903)	18.10 (N=241)	18.71 (N=235)	18.78 (N=218)	19.89 (N=209)

As Table 3 shows, schools participating in all three schemes (BTC, GCEB, and the DAS) have the lowest average overall junior class size of 14.21 pupils. This is to be expected, as a school must be participating in the urban dimension of BTC, in which maximum junior class sizes are 15 or below, to be included in this group. The group of schools with the next lowest average of 18.11 are those participating both in GCEB (i.e., are above the GCEB post-bar) and the DAS. However, this category also contains schools in BTC. If the BTC classes are removed, the average class size increases to 18.84. This value probably best reflects the average size of classes that benefitted under GCEB, as it describes class size in schools that are above the post-bar, including those already participating in the DAS. It should be noted that the majority of classes above the GCEB post-bar (84%) were also in the DAS (Weir & Archer, 2005). The average class size for this group compares favourably with averages for classes that were in the DAS only (23.24) or were neither in GCEB nor in the DAS (26.98). This suggests more long-standing positive discrimination towards schools serving disadvantaged pupils.

The data we have presented suggest that the introduction of GCEB resulted in positive discrimination towards participating schools compared to schools in other categories in terms of the size of their junior single-grade classes. However, positive discrimination in favour of schools with high levels of disadvantage was also in evidence in an examination of class sizes in schools participating in schemes that were the forerunners of GCEB.

CONCLUSION

In light of policy objectives to reduce class sizes and pupil-teacher ratios articulated by successive governments since the middle of the 20th century, the analyses described in this paper set out to examine the extent to which those objectives were realized and, in particular, the extent to which evidence of positive discrimination towards schools serving pupils in disadvantaged areas emerged from the 1980s onwards. Annual data on class size and pupil-teacher ratio revealed, with some exceptions, fairly steady reductions in class size and pupil-teacher ratio over the years examined, suggesting progress in relation to government objectives up to 2005/06. Evidence of positive discrimination towards schools in GCEB emerged from comparisons of their junior class sizes with those of schools nationally, and with schools that were not participating in any scheme for disadvantage. Similar evidence emerged from an examination of junior class sizes in schools involved in other schemes for disadvantage (e.g., the DAS). A trend analysis revealed further supporting evidence insofar as the years in which BTC and GCEB were introduced were associated with significant discontinuities in the annualized data on the percentage of junior classes with fewer than 20 pupils, suggesting that the introduction of both schemes had a system-wide, identifiable, impact on class size.

The findings relating to reductions in class size and pupil-teacher ratio may be situated in the demographic context of the time. For example, fluctuations in enrolments between 1968 and 2006 could have facilitated or impeded efforts at reduction. Increases in pupil numbers in the system would tend to have impeded such efforts, necessitating the appointment of additional teachers to offset increasing pupil numbers. This was, in fact, the situation during much of the period examined in this study. Following a peak in the birth rate around 1980, there was a consequent increase in annual total enrolments which reached the highest point in 1986/87. This was followed by a year-on-year decline in total enrolments until 2001/02 at

which point enrolments began to increase again (Department of Education and Science annual statistical reports for relevant years). It may be concluded, therefore, that reductions in class size and pupil-teacher ratio before 1986/87 and after 2001/02 (see Figures 1 and 2) were made in a climate which would have made policy implementation in this area more difficult.

There is some evidence that the downward trend in class size has flattened in recent years (see Figures 2 to 4). The levelling off of the trend in average class size (Figure 1) may suggest that further improvements in this area are unlikely to occur. Indeed, a situation in which there is pressure on public finances may impact negatively on class size due to forced decreases in teacher appointments. Furthermore, the observed decrease since 2003 in the percentages of junior pupils in classes of fewer than 20, and the accompanying increase in the percentage of junior pupils in classes of more than 30, may reflect an erosion of positive discrimination. The opposite may also occur. For example, if the number of pupils required to appoint or retain teachers generally was increased but the special provision for schools with high levels of disadvantage under DEIS was maintained, positive discrimination would be enhanced. It should be possible, using data from schools in DEIS, to investigate this issue by undertaking comparisons of the type conducted for this paper with GCEB schools. Annual data from future statistical reports may also be used to monitor trends in the system as a whole (e.g., in the percentages of junior pupils in classes of fewer than 20).

While international comparisons have been beyond the scope of the present paper, it is acknowledged that consideration needs to be given to the national data in a wider context. The regular publication by the OECD of *Education at a Glance* affords an opportunity to compare Ireland's pupil-teacher ratio with that of other countries for each of a number of years beginning in 1988. Similar comparisons can be made for class size beginning in 2000. As noted, attention is frequently drawn in the media to unfavourable comparisons involving Ireland. However, there has been little analysis of whether, if at all, Ireland's relative position has changed. Has the gap been reduced over time? Have other countries experienced reductions in pupil-teacher ratio and class size of the same magnitude as those in Ireland?

There is evidence that public policy that seeks to reduce pupil-teacher ratio and/or class size has widespread popular support (Kellaghan, McGee,

Millar, & Perkins, 2004). It is likely that such support is based on assumptions about the ways in which increases in the number of adults employed in a school will contribute to a situation in which the strengths, weaknesses, and needs of individual children can be identified and met. These seem reasonable assumptions and it is perfectly understandable that there is political support (especially among parents) for the belief that reductions in pupil-teacher ratio and class size will enhance the well-being of children.

Support for public policy in this area may also be based on the assumption that reduced pupil-teacher ratio and class size will contribute to improved educational outcomes (attainment and achievement) and, thereby, enhance children's life chances. Research support for this assumption, however, is mixed (Archer & Weir, 2005). Many correlational studies have failed to establish a relationship between class size and achievement (e.g., scores on a standardized test). It is of interest, in light of some recent policy choices of Irish governments, that a growing consensus seems to be emerging to indicate that there may be a critical threshold above which reductions make little difference, but below which achievement gains are observed. A number of researchers, beginning with Glass and Smith (1979) suggested that (a) the threshold is 20, (b) class size reductions are most effective with young pupils, and (c) children from disadvantaged backgrounds are more likely than other children to benefit. Since reducing pupil-teacher ratio and class size are expensive policy options, it is important that decisions in the future should be informed by cost-benefit analysis and ongoing monitoring of the extent to which previous policy objectives have been achieved.

APPENDIX

ARIMA (AUTO-REGRESSIVE INTEGRATED MOVING AVERAGE) MODELLING

Time series analysis usually proceeds from the assumption that sequences of measurement, taken at equally spaced intervals, consist of a systematic pattern and random noise and is, largely, a technique for separating these two components (i.e., filtering out the noise in order to assign meaning to the pattern or trend). Time series variables differ from other variables in that they are subject to serial dependency, that is, later observations in the series depend upon, or are predicted by, earlier ones.

Interrupted time series analysis is used when researchers wish to establish whether an outside event affected the observation(s) immediately following the event. This is done by looking for statistically significant departures from the underlying trend while also taking account of the possible existence of cycles within the overall trend and error (noise). These cycles are often referred to as seasonality in recognition of the fact that in many time series analyses, unlike those reported here, several observation per year are involved.

If a statistical technique such as ANOVA or regression is used to evaluate the impact of an intervention on a time series, the existence of serial dependency within the series will obscure the effect of the intervention. It is, therefore, desirable to first model the serial dependency within the time series before assessing the impact of the intervention, while controlling for that dependency (i.e., while holding the pattern of serial dependency constant).

Autoregressive Integrated Moving Average (ARIMA p, d, q) modelling is a statistical tool that can be used to model the serial dependency within a time series (McDowall et al., 1980). This technique models three kinds of serial dependency that can exist within a time series: the autoregressive component (p), which describes a series in which later observations are predicted by preceding ones, the integrated component (d), which reflects a trend or drift in the series, and the moving average component (q), which describes a series in which later observations are predicted by previous 'shocks' or the random errors attached to previous observations.

In the analysis carried out for this paper, an ARIMA (p, d, q) model was estimated for the three time series variables of interest (average class size, percentage of junior pupils in classes with fewer than 20 pupils, and percentage of junior pupils in classes with 30 or more pupils). Each time series was adequately represented by an ARIMA (1, 1, 0) model, indicating that each was marked by a significant trend and one autoregressive component.

Interrupted time series analyses were then conducted to investigate whether the introduction of BTC in 1997/98 and GCEB in 2001/02 had a significant effect on any of the three time series variables. The results revealed that the interventions had a significant impact on the percentage of junior pupils in classes with less than 20 pupils, but not on average class size or on the percentage of junior pupils in classes with 30 or more pupils. It seems that the GCEB intervention resulted in a greater increase in the percentage of pupils in classes that have less than 20 pupils ($B = 1.836$, $t = 7.782$, $df = 28$, $p < .001$) than the BTC intervention ($B = .882$, $t = 3.74$, $df = 28$, $p = .001$), but both interventions had a highly significant effect.

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