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The Use of the Irish Electoral Register for Population Estimation

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Précis: A strong relationship is shown to exist between the number of registered electors in a county and the county's population in census years. This relationship can be used to estimate county populations in intercensal years. Total population estimates for the years 1961 to 1979 are derived and are used to construct a net migration series for the same period. This series is compared with migration series implicit in the Central Statistics Office intercensal population series.

I INTRODUCTION

The recent publication of the preliminary results of the 1979 Census has led to substantial revisions in the Central Statistics Office estimates of the population for the years 1972-1978. The magnitude of these revisions, which in 1978 amounted to 90,000 persons or about 3 per cent of total population, has cast some doubt on the methodology used by the CSO to estimate the population in years when a census is not taken. Hughes (1980) has shown that the crucial problem in this methodology is the calculation of net annual migration, which the CSO estimates by reference to data on net passenger movement.

The present paper attempts to derive an alternative method for the calculation of population estimates in intercensal years. The data used are the numbers of electors in each county and county borough which are available annually. These figures have several desirable properties as a basis for population estimation:

(a) They are available quite quickly, usually by May of the year in question.

(b) They are independent of other data sources since a full count of the electorate is carried out each year. There is, therefore, no need to make assumptions about the pattern of net migration in deriving population estimates from the Electoral Register. Indeed, when the natural increase is subtracted from these estimates a series on net

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migration can be derived which is independent of the data on net passenger movement, which, in recent years, have proved unreliable as a basis for estimates of net migration.

(c) The population estimates obtained can be broken down by county and county borough.

This paper begins with a description of the Electoral Register. It then goes on to discuss some ways in which it can be used to make population estimates and to assess the quality of these estimates. Regional breakdowns are also given. The time series on net migration implicit in the population estimates is then examined and compared with that implicit in the population estimates published by the CSO.

II THE ELECTORAL REGISTER

Each year the Franchise Sections of the various county councils and county borough councils publish a Register of Electors giving the names and addresses of those eligible to vote in Dáil, Local Government and European Assembly elections. This register comes into effect on the 15th of April in each year. A count of the number of electors of each type in each Dáil constituency and in each county or county borough is available from the Franchise Section of the Department of the Environment by about May of the year in question. These counts are subsequently published in the Statistical Abstract.

Appendix Table A.1 shows the number of electors aged 21 and over in each county and county borough in the years 1961-79. This time period was selected because the number of electors in each county and county borough are not published for years prior to 1961. The boundaries of the boroughs have, in some cases, changed since 1961, but the newly defined boundaries were consistently used in both the censuses and the Electoral Registers.

One aspect of these data proved troublesome. The voting age was lowered from 21 to 18 in 1973, which led to a sudden increase in the recorded number of electors in that year. In order to maintain consistency, the data for the years 1973 to 1979 had to be adjusted. This was accomplished by estimating the number of persons aged 18-20 in each year, using the 1971 Census combined with the 1970-72 Life Table (*Statistical Bulletin*, March 1976). These estimates were then subtracted from the Electoral Register as published to obtain the figures shown in Table A.1.

Of course, this adjustment procedure assumes zero net migration in the 18-20-year-old age group. It might be argued that this age group is one of those most prone to emigration and hence that it would be preferable to

assume some positive level of net emigration in making the adjustment. However, until the age distribution for 1979 is published, it cannot be established that net emigration did actually occur in this age group. Furthermore, it must be borne in mind that, in any given year, immigration at ages under 18 in previous years will serve to swell the younger cohorts, thus increasing the size of the 18-20 age group in the year in question beyond what would be expected from the 1971 Census.

III ESTIMATING THE POPULATION FROM THE ELECTORAL REGISTER

Probably the simplest way of using the Electoral Register to estimate population is to assume that the ratio between Register and population is constant between censuses. Thus, to estimate the population in any year t, one calculates $(P^*/E^*).E_t$ where E^* denotes the number of persons on the Electoral Register, P^* the population at the time of the previous census, and E_t the number of persons on the Register in year t. The results of carrying out this exercise for each census year since 1946 are shown in Table 1.

Table 1: *Number of persons recorded in the Electoral Register (E_t) and the Census of Population (P_t) and total population as estimated from E_t (P_{t-1}/E_{t-1}) in census years from 1951 to 1979*

Year	*Number of persons on Electoral Register**	*Census of the Population*	*Population as estimated from Electoral Register*	*Difference*
1946	1,823,864	2,955,107	—	—
1951	1,805,711	2,960,593	2,925,695	34,898
1956	1,762,097	2,898,264	2,889,085	9,179
1961	1,691,084	2,818,341	2,781,463	36,878
1966	1,726,221	2,884,002	2,876,900	7,102
1971	1,780,796	2,978,248	2,975,181	3,067
1979	2,011,811	3,364,881**	3,364,603	278

* The figures for the number of electors in 1979 has been adjusted as described above so as to reflect the likely number of electors aged 21 and over.

** Here and elsewhere in this paper, the figure used for the 1979 Census is that published in the Preliminary Report of the Census. This has recently been revised by 3,336, but this small revision does not materially affect any of our results.

The difference between the census figures and the estimate is over 30,000 in 1951 and 1961, but is less than 10,000 in 1956, 1966, 1971 and 1979. The two figures are almost identical in 1979, but it should be recalled that

the Electoral Register shown excludes the estimated number of persons aged 18-20. If there was substantial immigration of persons in this age group, then the figure for 1979 would be somewhat understated, so leading to a larger (positive) difference between census figure and estimate. It is noteworthy that the population was under-estimated in each of the years shown (i.e., the difference is always positive), suggesting that the ratio (P/E) has been rising over time.

One explanation for this persistent tendency to underestimate might be that this ratio varies as between regions. Hence, differential rates of population change in the different regions might lead to persistent under-estimates. A disaggregated estimating method might, therefore, be more efficient than the simple ratio approach outlined above. Unfortunately, disaggregated (county) data for the Electoral Register are available only since 1961. The years in which both census data and the Electoral Register were available on a county basis were, therefore, 1961, 1966, 1971 and 1979. Given the problems posed by changes in the voting age, it was decided to omit 1979 from the data on which the estimating procedure was based.

Initially we thought of deriving our estimating procedure from a regression equation of the following form:

$$P_{it} = a + bE_{it} + \sum_{j=1}^{30} c_j D_{itj}$$

where i = county (i = 1 . . . 31),

t = time (t = 1961, 1966, 1971),

P_{it} is the census population in county i in year t,

E_{it} is the number of local government electors in county i in year t,

a and b are constants to be estimated,

c_j (j = 1 . . . 30) are a set of regression coefficients, and

D_j (j = 1 . . . 30) are a set of dummy variables such that when

i = j, $D_{itj} = 1$ and when

$i \neq j$, $D_{itj} = 0$ for all values of t.

These dummy variables (D_j, j = 1, ..., 30) were designed to test whether the intercept coefficient of the above equation varied significantly as between counties.

However, it soon became clear that heteroscedasticity was a problem, since the values of P_{it} and its variance varied very substantially across counties. We, therefore, adopted the following specification:

$$P_{it}/E_{it} = a + \sum_{j=1}^{30} d_j D_{itj}$$

where the $d_j (j = 1 \ldots 30)$ are a set of regression coefficients and the other symbols have the meanings assigned to them above.

This equation embodies the basic assumption that the ratio of the population of a county to its Electoral Register is constant across all three census years. A number of factors may influence this ratio, including the age structure of the population (e.g., counties with above average percentages of persons aged 0-20 will have a higher than average ratio) and the pattern of registration (e.g., persons living away from the family home may sometimes be included in the Electoral Register of their county of origin, rather than their county of residence). These and other deficiencies of the Electoral Register will not detract from its usefulness in estimating population, provided they remain relatively constant from year to year.

Of course, if one were to use this regression equation to estimate population over long periods of time, the assumption of constancy in this ratio could be invalid since the age structure of a county might change substantially. However, these difficulties are unlikely to be serious when one is using the method as a means of estimating population in intercensal years. As soon as the results of a new census become available, the coefficients can be re-estimated, thus incorporating the latest information on the age structure of each county in the estimating method.

The intercept (a) and the coefficients (d_j) were estimated using Stepwise Least Squares Regression, giving the equation shown in Table 2. Nine counties had insignificant coefficients and these are excluded from the equation. If one wishes to estimate the population of one of these excluded counties in a particular year, one simply multiplies its Electoral Register in that year by the constant, a = 1.7149. To obtain an estimate of the population of any of the counties included in Table 2 (i.e., those with significant coefficients) one adds the entry in Table 2 corresponding to the county to the constant 1.7149 and then multiplies the resulting figure by the Electoral Register. For instance, to estimate Mayo's population, one would multiply its Electoral Register by 1.5939 (= 1.7149 − 0.1210).

The pattern shown in the coefficients is interesting. They are substantial and positive in Limerick County Borough and in Dublin County, about zero in the other county boroughs, and substantial and negative in most of the western and north-western counties. Some explanations for this pattern are discussed below. We also tested a version of this equation which included additional dummy variables to test for year-to-year variation, but none of these proved significant.

Table 2: *Estimates of d_j in the prediction equation $P/E = \sum_j d_j D_j$ based on data for 1961, 1966 and 1971*

County/county borough	*Coefficient*	*t-value*
Limerick County Borough	0.1365	9.39
Dublin County	0.1149	7.91
Kildare	0.0399	2.75
Cork County Borough	0.0361	2.49
Kilkenny	−0.0414	2.85
Wexford	−0.0463	3.19
Louth	−0.0623	4.29
Wicklow	−0.0650	4.47
Limerick County	−0.0834	5.74
Tipperary North Riding	−0.0899	6.19
Cork County	−0.1092	7.52
Waterford County	−0.1205	8.29
Mayo	−0.1210	8.33
Kerry	−0.1317	9.06
Monaghan	−0.1364	9.39
Longford	−0.1436	9.88
Sligo	−0.1462	10.06
Cavan	−0.1565	10.77
Clare	−0.1802	12.40
Roscommon	−0.1808	12.45
Donegal	−0.1898	13.06
Leitrim	−0.2603	17.91
Constant	1.7149	

$R^2 = 0.9501$ Overall F-value = 60.58 with (22, 70) d.f.
All coefficients are significant at the 5% level; the overall F-value and coefficients with t-statistics greater than 2.66 are significant at the 1% level.

So far we have concentrated on estimates of the total population. An important feature of the present estimation method is the regional estimates which it provides. This represents an advantage over the CSO's annual intercensal estimates which are not broken down by county. Indeed, even in census years the regional figures only become available after some time, whereas the Electoral Register estimates are available by about May. Population estimates for the four census years, broken down by county and county borough, are shown in Appendix Table A.2, together with the corresponding census figures. In general, the concordance between the two sets of figures is very good. For instance, the percentage errors in 1979 vary from −6.1 to 4.3.

IV EVALUATION OF THE ESTIMATES

Table 3 shows (a) the estimates derived from the ratio of P_t to E_t, (b) those derived from the regression by aggregating across all 31 counties and county boroughs, (c) the CSO's pre-census estimates and (d) the CSO's post-census estimates. One way of evaluating the accuracy of population estimates based on the Electoral Register is to ascertain if they differ from the CSO's final (post-census) estimate by less than the revision the CSO makes between its own pre- and post-census estimates. On this criterion, it seems that, in the period 1962-1970, the CSO's estimates are in general more accurate than either of those based on the Electoral Register. The Root Mean Square Error* (RMSE) for the CSO's pre-census estimate in the inter-censal years 1962-70 is 10.3, compared with 21.5 for the Electoral Register ratio estimate and 24.0 for the regression estimate. Between 1972 and 1978, however, the situation is dramatically reversed; the RMSE for the ratio estimate falls to 19.5 and that of the regression to 16.3, while that of the CSO's pre-census estimates rises to 55.8.

However, in all periods the error of closure (i.e., the error in the year immediately preceding the census) is lower for the ratio estimate than for the CSO's pre-census estimate. The regression estimate has a lower error of closure in each of the relevant years except 1965.

Indeed, comparison between the estimates based on the Register and the CSO's post-census estimates may not be appropriate since the post-census estimate is likely to be based to some extent on the same data as the pre-census figure. If, for instance, the annual short-term pattern of migration derived from the net passenger movement series was erroneous, both the pre- and post-census estimates would be affected in the same way. Thus the pre- and post-census estimates might agree, but fail to reflect the true population.

There has been some speculation that the unprecedented growth in population between 1971 and 1979 was due in part to under-counting in the 1971 Census. Walsh (1979) has argued that this is unlikely in view of the regional pattern of the recorded increases in population. The Electoral Register data can be used to cast some light on this issue. The ratio estimate of the population for 1971 as shown in Table 3 is 2975.2, about three thousand *lower* than the census figure. If substantial undercounting had occurred in 1971, one would expect this estimate to be considerably in excess of the census figure. Two slightly more elaborate tests were also carried out. In the first, the regression equation was re-estimated on the

* RMSE $= \left(\sum_{i=1}^{n} (X - Y)^2/n \right)^{1/2}$ where X is the estimate being evaluated, Y the CSO's post-census estimate and n the number of intercensal years in question.

Table 3: *Total population 1961-79 (a) as estimated from $(P^*/E^*)E_t$, (b) from the regression in Table 1, (c) the CSO's pre-census estimate, and (d) the CSO's post-census estimate (census years underlined)*

Year	*Estimate derived from Electoral Register by ratio (a)*	*Estimate derived from Electoral Register by regression (b)*	*CSO pre-census estimate (c)*	*CSO post-census estimate (d)*	*Differences*		
					(e) = (d) − (a)	*(f) = (d) − (b)*	*(g) = (d) − (c)*
1961	2781.5	2810.7	—	2818.3	36.8	10.9	—
1962	2816.9	2810.6	2824.0	2830.0	13.0	17.0	6.0
1963	2811.3	2806.5	2841.0	2850.0	39.0	43.0	9.0
1964	2827.4	2823.9	2849.0	2864.0	37.0	40.0	15.0
1965	2856.4	2854.1	2855.0	2876.0	20.0	22.0	21.0
1966	2876.9	2878.8	—	2884.0	7.1	5.2	—
1967	2893.0	2889.1	2899.0	2990.0	7.0	11.0	1.0
1968	2901.4	2898.5	2910.0	2913.0	12.0	15.0	3.0
1969	2933.1	2931.9	2921.0	2926.0	−7.0	−6.0	5.0
1970	2951.4	2951.6	2944.0	2950.0	−1.0	−2.0	6.0
1971	2975.2	2976.4	—	2978.2	3.0	1.9	—
1972	3021.6	020.9	3,014.0	3,024.0	2.0	3.0	10.0
1973	3053.1	3054.9	3051.0	3072.0	19.0	17.0	21.0
1974	3106.0	3109.7	3089.0	3123.0	17.0	13.0	34.0
1975	3143.3	3148.5	3127.0	3176.0	33.0	27.0	49.0
1976	3193.8	3200.2	3162.0	3226.0	32.0	26.0	64.0
1977	3272.8	3281.3	3192.0	3269.0	−4.0	−12.0	77.0
1978	3299.9	3309.3	3221.0	3311.0	11.0	2.0	90.0
1979	3364.6	3382.0	—	3364.9	0.3	−17.1	—

Note: In columns (c) to (g) the figures for the intercensal years have been rounded to the nearest thousand.

basis of data for 1961, 1966 and 1979 and used to estimate 1971. The second used the data for 1961 and 1966 to estimate 1971. The first test yielded an estimate for 1971 of 2975.4 thousand and the second 2972.9 thousand, both of which are slightly below the census figure. Thus, the present data lend no support to the contention that the 1971 Census seriously under-estimated the country's population.

V POSSIBLE EXPLANATIONS FOR THE INTER-COUNTY VARIATIONS IN P/E

It was noted above that dummy variables representing 22 of the 31 counties and county boroughs were significant in the regression. This raises the question of why there were systematic variations in the ratio as between the different counties. Two explanations suggested themselves: (a) that the variation was due to the age structure of the counties, specifically the proportion of the population under 21, and (b) that counties might vary in the extent to which all those eligible to vote there were recorded in the census. For example, it seemed possible that in counties with high levels of emigration, some persons might be registered to vote in their county of origin, but were actually resident in, say, Dublin or some other city or town.

The pattern of coefficients shown in Table 2 is consistent with both of these explanations. The positive coefficients in the county boroughs imply a higher population than would be expected on the basis of the Register. These areas have high rates of net immigration and high proportions of the population under 21. Negative coefficients are obtained in the western and north-western counties where net emigration is prevalent and where low proportions of the population are under 21.

To examine the relative importance of the two explanations, two additional regressions were run and these are shown in Table 4, together with the original equation from Table 1. The first equation (i) regresses the ratio of total census population to census population over 21 on the county dummies. This equation reflects the "pure" age structure as distinct from fluctuations due to the registration pattern. The second equation (ii) regresses the ratio of the population over 21 to the Electoral Register. This should eliminate the age structure effect and thus clarify the "pure" influence of the registration pattern.

In both equations, only those variables are retained for which the coefficients are significant. In view of the higher R^2's and larger number of coefficients in Equation (i), it seems that most of the variation which we set out to explain is due to variations in the age structure across counties. However, there appear to be quite sizeable variations in the boroughs of Water-

Table 4: *Regressions of (i) P/P^{21+}, (ii) P^{21+}/E, and (iii) P/E on various county dummies for the years 1961, 1956 and 1971*

County/county borough	*Regression (i)* $P/P^{21+}=a+\sum_j b_j D_j$		*Regression (ii)* $P^{21+}/E=a+\sum_j b_j D_j$		*Regression (iii) (from Table 1)* $P/E=a+\sum_j b_j D_j$	
	Coefficient	*t-value*	*Coefficient*	*t-value*	*Coefficient*	*t-value*
Limerick County Borough	0.1111	6.39	0.0574	4.88	0.1365	9.39
Dublin County	0.0818	4.70	0.0592	5.28	0.1149	7.91
Kildare	0.1302	7.49	N.S.		0.0399	2.75
Cork County Borough	N.S.		0.0455	4.06	0.0361	2.49
Kilkenny	N.S.		N.S.		−0.0414	2.85
Wexford	N.S.		N.S.		−0.0463	3.19
Louth	0.0440	2.53	N.S.		−0.0623	4.29
Wicklow	N.S.		N.S.		−0.0650	4.47
Limerick County	N.S.		N.S.		−0.0834	5.74
Tipperary North Riding	N.S.		N.S.		−0.0899	6.19
Cork County	−0.0678	3.90	N.S.		−0.1092	7.56
Waterford County	−0.0504	2.90	N.S.		−0.1205	8.29
Mayo	N.S.		N.S.		−0.1210	8.33
Kerry	−0.0683	3.93	N.S.		−0.1317	9.06
Monaghan	−0.0649	3.73	N.S.		−0.1364	9.39
Longford	−0.0376	2.16	−0.0224	2.00	−0.1435	9.88
Sligo	−0.0791	4.55	N.S.		−0.1462	10.06
Cavan	−0.0785	4.51	N.S.		−0.1565	10.77
Clare	−0.0858	4.93	N.S.		−0.1802	12.40
Roscommon	−0.1035	5.95	N.S.		−0.1808	12.44
Donegal	−0.0522	3.07	−0.0423	3.77	−0.1898	13.06
Leitrim	−0.1514	8.71	−0.0287	2.56	−0.2603	17.92
Meath	0.0642	3.69	N.S.		N.S.	
Offaly	0.0591	3.40	N.S.		N.S.	
Carlow	0.0520	2.99	N.S.		N.S.	
Westmeath	0.0360	2.07	0.0336	3.00	N.S.	
Waterford County Borough	N.S.		0.0674	6.01	N.S.	
Dublin County Borough	N.S.		0.0389	3.47	N.S.	
Laois	N.S.		0.0377	3.36	N.S.	
Galway	N.S.		N.S.		N.S.	
Tipperary South Riding	N.S.		N.S.		N.S.	
Constant	1.7078		0.9633		1.7149	
R^2	0.8558		0.6578		0.9501	
Overall F-value	22.80		14.16		60.58	

P = Total population according to the Census of the Population.
P^{21+} = Total population aged 21 and over.
E = Number of persons on the Electoral Register.
N.S. means the coefficient has a t-value insignificant at the 5% level.

ford, Cork and Limerick and in counties Dublin and Donegal which cannot be explained by the age structure of these counties alone.

VI THE IMPLICIT NET MIGRATION SERIES

Given any annual series of population estimates, one can derive a series on net migration, NM, from the identity

$$P_t = P_{t-1} + NI_{t-1} + NM_{t-1}$$

where P_t is the population at the beginning of the year t and NI_t is the natural increase in year t. The net migration series implicit in the Electoral Register estimates (EMR and EMG) and the CSO's estimates (CM) are shown in Table 5 and in Figure 1 (see p. 317).

Table 5: *Net migration 1961-1978 as estimated from (a) ratio (i.e., (P*/E*) E_t) (b) regression in Table 1 and (c) the CSO's population estimates.*

	Net migration implicit in		
*Year**	*Electoral Register ratio estimate EMR*	*Electoral Register regression estimate EMG*	*CSO population estimates CM*
1961	−28.2	−26.8	−14.9
1962	−33.9	−32.5	−8.2
1963	−14.6	−13.3	−16.6
1964	−2.2	−1.0	−19.5
1965	−1.5	−4.5	−20.6
1966	−20.2	−19.2	−13.4
1967	−20.5	−20.0	−15.7
1968	4.0	5.6	−15.0
1969	−11.0	−9.6	−5.5
1970	−6.3	−8.4	−4.3
1971	8.8	10.0	10.7
1972	−4.0	−1.6	12.8
1973	18.4	20.3	16.3
1974	3.5	4.9	19.1
1975	16.0	17.1	15.4
1976	45.0	47.2	9.0
1977	−8.3	−7.3	6.6
1978	29.9**	31.1**	17.1**

* April of the stated year to April of the next year.

** Estimates, assuming that births and deaths in the first quarter of 1979 equal those in first quarter of 1978.

Both the Electoral Register estimates exhibit a very similar pattern (r = 0.997). They are both considerably more variable than that implicit in the CSO's figures. It also appears that the Electoral Register estimates lag behind the CSO's figures by about two years. This is confirmed by computing the correlation between the two series for various lags, as shown in Table 6.

Table 6: *Correlation coefficients between estimates of net migration based on (a) Electoral Register and (b) CSO estimates, with various lags.*

Variables	*t = lag (years)* 0	1	2	3	4
CM, EMR_{-t}	0.578*	0.604*	0.646**	0.634*	0.509
CM, EMG_{-t}	0.599*	0.608*	0.658**	0.644*	0.498

*Value significant at the 5 per cent level.
**Value significant at the 1 per cent level.

A lag of this type in the relationship between the two series is to be expected since it will probably take some time for a person to get on to the Electoral Register, whereas the CSO's estimates are based on net passenger movement data which are collected at the time of migration. However, the length of the lag appears greater than one would have expected on *a priori* grounds.

There seems to be a certain periodicity in EMR and EMG which does not occur in CM. The apparent length of the period (about 3-4 years) would lead one to suspect that the occurrence of elections, which are held about every four years, influences the accuracy of the Electoral Register. It would seem plausible that in years when an election takes place the Register is thoroughly checked and that it is, therefore, more accurate in the years immediately succeeding an election than in other years.

However, the type of effect to be expected is not clear. On the one hand, the expectation of an election in a given year might induce more new voters to register than would otherwise do so. On the other hand, the checking of the register by the various political parties prior to an election probably leads to a net decrease in the number of names on the Register since those who have died and those who have moved out of the constituency will be eliminated. The timing of elections will also determine the year in which the effect manifests itself. For instance, if an election is held in February or March of a given year, it is unlikely to affect the Electoral Register until April of the next year, whereas an election held in October probably influences the Register published in the following April.

To give some idea of the effect of elections we have marked on the graph the dates on which general elections were held (i.e., October 1961, April 1965, June 1969, February 1973 and June 1977). Although the

pattern is not entirely uniform, troughs in the graph appear in general to follow elections. This would suggest that the elimination of ineligible voters is the stronger of the two effects described above.

The high variability in the EMR and EMG series, as well as the observed lag, illustrate some of the problems involved in using the Electoral Register for estimating year-to-year changes in population. For instance, the method suggested here might not be sensitive enough to pick up the first year of a down-turn in population. However, it seems much more likely to be able to identify a reversal which lasts two or three years. Thus, the method would still have something to recommend it, since the alternative "passenger balance" method failed to identify just such a sustained reversal of trend in the years 1971-1978. The variability in the migration estimates could perhaps be moderated by deriving them from a moving average of the intercensal population estimates, rather than from the annual figures.

VII CONCLUSION

We have shown that the Electoral Register can provide quite accurate estimates of total population, as well as some information about net migration. These estimates are available quickly and on a disaggregated (county) basis.

For some purposes, an even more disaggregated estimate would be useful. In theory, it should be possible to carry out a regression analysis of the type outlined above on the basis of the 3,000 or so District Electoral Divisions (DEDs). However, there is a practical problem in carrying out the analysis, since the Electoral Register figures are not published on a DED basis. In fact, the polling districts or wards into which the Register is divided do not, in general, correspond to the DEDs. As part of the development of the RANSAM, the ESRI's computer-based sample selection system, work is proceeding to solve this problem by disaggregating each polling district into its constituent parts and re-combining these into DEDs. It is hoped to publish population estimates by DED in the near future. Of course, it is to be expected that the errors involved in estimating population might be greater at DED level than at county or national level.

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Table A1: *Numbers of local government electors in each county and county borough, 1961-1979*

	1961	*1962*	*1963*	*1964*	*1965*	*1966*	*1967*	*1968*	*1969*
County boroughs									
Cork	45,783	45,782	45,424	45,940	46,148	68,995	69,437	70,181	70,889
Dublin	312,071	315,367	317,488	316,479	318,538	321,363	324,305	325,103	328,583
Limerick	27,328	27,921	28,058	29,427	29,732	30,188	30,204	30,348	30,332
Waterford	16,387	16,652	16,807	16,968	17,236	17,389	17,628	17,712	17,918
Counties									
Carlow	19,017	18,786	18,753	19,158	19,618	19,514	19,514	19,493	19,779
Cavan	36,122	35,738	35,119	34,827	34,558	34,497	34,460	34,166	34,153
Clare	47,526	46,788	46,840	47,431	47,760	48,362	48,419	48,263	48,341
Cork	155,369	155,677	155,253	155,298	157,868	137,116	137,250	137,428	138,185
Donegal	72,471	72,378	71,793	72,186	71,923	72,213	72,039	71,770	71,829
Dublin	100,767	103,896	107,771	112,934	119,794	124,147	128,374	133,146	141,063
Galway	86,936	86,593	86,328	86,500	88,941	88,451	87,877	87,094	88,123
Kerry	72,915	71,472	70,845	71,503	71,862	71,444	70,414	70,471	71,066
Kildare	36,524	36,439	36,198	37,007	37,196	37,812	38,345	38,393	39,125
Kilkenny	36,444	36,347	36,074	36,494	36,504	36,424	36,414	36,221	36,660
Laoighis	26,773	26,446	26,041	26,506	26,537	26,335	26,388	26,283	26,442
Leitrim	22,754	22,277	21,786	21,340	21,124	21,102	20,704	20,433	20,015
Limerick	50,346	49,915	49,664	49,472	49,136	49,808	49,644	50,378	50,618
Longford	18,986	19,929	19,527	18,477	18,306	18,579	18,424	18,322	18,225
Louth	41,729	42,443	42,326	41,374	41,756	41,785	41,969	42,450	43,150
Mayo	77,068	75,376	75,481	72,685	73,082	72,572	71,366	70,730	70,224
Meath	37,920	37,918	47,994	38,512	39,099	40,023	40,237	40,727	41,090
Monaghan	29,470	29,293	28,857	28,528	29,598	29,230	29,284	29,027	29,069
Offaly	30,111	29,889	29,932	29,906	29,757	29,998	30,035	29,869	29,949
Roscommon	38,279	37,816	35,673	37,238	37,124	36,933	36,528	35,909	35,654
Sligo	34,557	34,065	33,379	33,241	33,121	32,540	32,373	32,147	32,205
Tipperary (N.R.)	32,603	32,400	32,140	32,561	32,706	33,897	33,116	32,887	33,216
Tipperary (S.R.)	41,353	40,925	40,517	41,232	40,922	40,710	40,728	40,835	41,162
Waterford	27,518	27,286	27,012	27,073	27,101	27,162	27,594	27,328	27,606
Westmeath	30,265	30,062	29,875	30,838	30,955	30,448	30,580	30,492	30,704
Wexford	49,570	49,556	49,269	49,509	49,921	50,332	50,534	51,067	51,783
Wicklow	36,120	35,896	35,753	35,895	35,966	36,852	37,464	37,939	38,427

Table A1: *(continued)*

	1970	*1971*	*1972*	*1973**	*1974**	*1975**	*1976**	*1977**	*1978**	*1979**
County boroughs										
Cork	71,597	72,298	73,375	74,804	75,299	75,520	75,858	76,596	77,061	77,589
Dublin	329,981	331,404	333,756	334,258	334,269	334,771	334,614	337,892	328,513	328,931
Limerick	30,625	31,005	31,727	32,220	33,242	33,162	33,463	33,769	33,932	34,372
Waterford	18,152	18,290	18,520	18,670	18,780	18,598	18,386	18,311	18,319	18,444
Counties										
Carlow	19,878	20,025	20,289	20,367	20,830	21,218	21,374	21,952	22,421	22,757
Cavan	34,087	34,112	34,104	34,149	34,451	34,607	34,719	34,700	34,737	35,047
Clare	48,640	48,977	49,449	50,422	51,436	51,694	52,520	51,921	52,489	53,819
Cork	138,856	139,684	141,614	141,116	142,940	145,072	147,444	151,839	153,239	156,045
Donegal	71,890	72,167	72,597	71,631	71,475	71,768	72,640	73,936	74,986	76,328
Dublin	147,506	152,558	160,129	169,889	181,961	192,386	202,374	228,113	228,283	240,330
Galway	88,421	88,583	89,289	91,606	94,241	94,816	96,968	99,992	101,237	103,819
Kerry	71,117	71,666	72,817	72,875	73,267	73,980	75,074	76,388	76,688	77,930
Kildare	39,853	41,260	43,097	45,815	47,410	48,212	49,961	51,986	52,696	55,078
Kilkenny	36,620	36,845	36,813	37,065	37,641	38,146	38,718	39,492	39,900	40,991
Laoighis	26,309	26,233	26,359	26,335	26,894	26,698	26,898	27,592	28,212	25,098
Leitrim	19,731	19,638	19,421	18,872	19,029	18,710	18,699	18,967	18,997	19,122
Limerick	50,905	51,435	51,585	53,679	54,279	55,284	56,381	56,921	58,594	58,844
Longford	18,181	18,348	18,678	18,390	18,438	18,118	18,197	18,375	18,617	19,073
Louth	43,891	44,630	45,171	45,284	46,090	46,726	47,864	49,218	50,058	50,783
Mayo	69,314	68,917	68,961	69,023	69,938	70,207	71,939	73,528	73,895	75,250
Meath	41,772	42,406	43,509	44,320	46,258	47,383	48,760	50,283	51,543	53,378
Monaghan	29,092	29,397	29,588	29,014	29,006	29,667	30,442	30,653	30,870	31,401
Offaly	29,918	30,171	30,309	29,888	30,225	30,371	30,986	31,858	32,439	33,178
Roscommon	35,207	34,918	35,631	34,158	33,828	33,766	33,506	33,875	33,607	33,908
Sligo	31,821	31,080	32,238	31,611	32,289	32,428	32,491	33,268	33,563	34,421
Tipperary (N.R.)	33,194	33,142	33,225	33,560	33,695	33,403	33,843	34,670	34,920	35,317
Tipperary (S.R.)	40,981	41,034	41,345	41,581	41,776	42,106	42,624	43,436	43,783	45,131
Waterford	27,865	27,984	28,454	28,972	29,626	30,118	30,402	31,418	31,972	32,885
Westmeath	30,840	30,964	31,313	31,379	31,813	32,141	32,272	33,172	33,690	35,109
Wexford	51,661	51,793	53,098	53,269	53,856	54,116	54,941	55,548	56,370	57,658
Wicklow	38,664	39,204	40,252	41,344	42,795	44,307	45,352	47,263	47,492	49,776

*As explained in the text, these figures have been adjusted to take account of the lowering of the registration age from 21 to 18 years in 1973.

Table A.2: *Numbers of persons in each county and county borough in 1961, 1971 and 1979 (a) as recorded in the Census and (b) as estimated from the Electoral Register.*

	1961		*1966*		*1971*		*1979*		*% error*
	Census	*Estimate*	*Census*	*Estimate*	*Census*	*Estimate*	*Census*	*Estimate*	*1979*
County boroughs									
Cork	77,980	80,166	122,146	120,810	128,645	126,593	138,092	135,957	1.618
Dublin	537,448	535,163	567,802	551,098	567,866	568,317	543,563	564,075	−3.734
Limerick	50,786	50,594	55,912	55,889	57,161	57,402	60,769	63,633	−4.713
Waterford	28,216	28,102	29,842	29,820	31,968	31,365	32,617	31,629	3.029
Counties									
Carlow	33,342	32,612	33,593	33,464	34,237	34,340	38,649	39,025	−0.973
Cavan	56,594	56,293	54,022	53,761	52,618	53,161	53,706	54,648	−1.754
Clare	73,702	72,937	73,597	74,220	75,008	75,164	84,823	82,596	2.625
Cork	252,463	249,466	217,557	220,158	224,238	224,282	257,643	250,551	2.753
Donegal	113,842	110,526	108,549	110,133	108,344	110,063	121,599	116,409	4.268
Dublin	180,884	184,384	227,245	227,165	284,353	279,152	439,023	439,758	−0.167
Galway	149,887	149,084	148,340	151,683	149,223	151,909	167,792	178,037	−6.106
Kerry	116,458	115,434	112,785	113,105	112,772	113,457	120,281	123,374	−2.571
Kildare	64,420	64,092	66,404	66,353	71,977	72,403	97,063	96,668	0.407
Kilkenny	61,668	60,989	60,463	60,956	61,473	61,660	69,115	68,598	0.748
Laois	45,069	45,012	44,595	45,161	45,459	44,986	49,007	49,198	−0.389
Leitrim	33,470	33,098	30,572	30,695	28,360	28,566	27,827	27,816	0.040
Limerick	82,553	82,137	81,445	81,260	83,298	83,914	96,605	96,002	0.624
Longford	30,643	29,833	28,989	29,194	28,250	28,831	30,777	29,970	2.622
Louth	67,378	68,961	69,519	69,053	74,951	73,755	86,180	83,923	2.619
Mayo	123,330	122,838	115,547	115,672	109,525	109,846	113,751	119,940	−5.441
Meath	65,122	65,028	67,323	68,634	71,729	72,721	90,589	91,537	−1.046
Monaghan	47,088	46,517	45,732	46,139	46,242	46,402	50,358	49,565	1.575
Offaly	51,533	51,637	51,717	51,443	51,616	51,568	57,183	56,895	0.504
Roscommon	59,217	58,721	56,228	56,657	53,519	53,566	54,095	52,016	3.843
Sligo	53,561	54,207	51,263	51,043	50,275	49,895	54,609	53,993	1.128
Tipperary N.R.	53,596	52,979	53,843	55,082	54,337	53,955	58,448	57,390	1.810
Tipperary S.R.	70,126	70,915	68,969	69,813	69,228	70,368	75,215	77,393	−2.896
Waterford	43,223	43,873	43,238	43,306	45,347	44,616	54,635	52,431	4.034
Westmeath	52,861	51,901	52,900	52,215	53,572	53,099	59,915	60,208	−0.489
Wexford	83,308	82,709	83,437	83,980	86,351	86,418	96,259	96,204	0.057
Wicklow	58,473	59,593	60,428	60,801	66,295	64,682	83,793	82,124	1.992
Total	2,818,341	2,810,704	2,884,002	2,878,760	2,978,248	2,976,355	3,364,881	3,381,973	−0.508

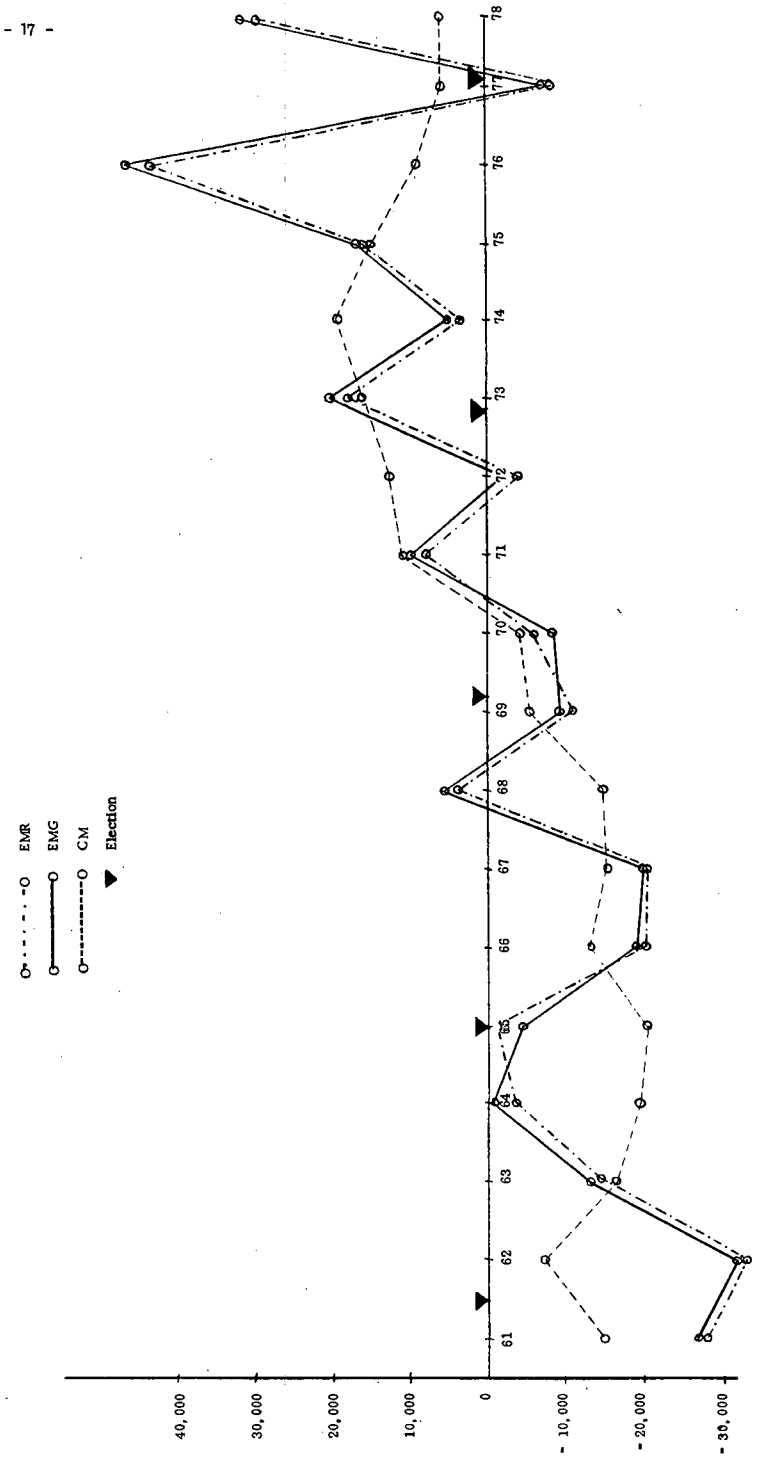

Figure 1: Net Migration as calculated in Table 5 for the years 1961-1978.