Social Mobility Over Three Generations in Finland: A Critique

Tak Wing Chan¹,* and Vikki Boliver²

Abstract: Erola and Moisio (2007) argue that in Finland the class positions of grandparents and grandchildren are almost independent of each other, once parents’ social class has been taken into account. We show that this conclusion of ‘almost conditional independence’ is not supported by the results reported in their article. We further show that the strong evidence against conditional independence is not due to the large N of the Finnish mobility table alone, as the same critique applies to much smaller subsamples drawn randomly from the data. We then demonstrate with some illustrative outflow mobility rates that the grandparents effect in social mobility in Finland is not only statistically significant, but is of substantive importance. Finally, we discuss the two ‘lagged’ effects reported in Erola and Moisio (2007), and show that they fail to capture much of the net GC association.

Introduction

In an article published in the European Sociological Review, Erola and Moisio (2007, p.169, hereafter as EM) argue that in Finland ‘[a]fter controlling for parents’ social class, the grandchildren’s social class is almost conditionally independent from the grandparents’ social class’. This is a Markovian view of social mobility: grandparents’ class position affects parents’ class outcome, and, in turn, parents’ class position influences grandchildren’s class outcome, but there is no direct grandparents effect on grandchildren, once parents’ social class has been taken into account.

We make four claims in this article. Firstly, we argue that EM’s conclusion is not supported by the results reported in their article. Secondly, we demonstrate that the strong evidence against conditional independence is not due to the large N of the Finnish mobility table alone. Our critique remains valid when the same analysis is applied to much smaller subsamples drawn randomly from the Finnish data. Thirdly, we show that the net grandparents effect is of substantive importance, as demonstrated by some illustrative outflow mobility rates. Fourthly, we discuss the two ‘weak lagged effects’ identified by EM. We show that they fail to capture much of the net GC association in the data, and they do not support EM’s main claim of ‘almost conditional independence’.

The Evidence Against Conditional Independence

EM base their conclusion on a loglinear analysis of a three-way contingency table cross-classifying the class positions of grandparents (G), parents (P), and children (C).¹ The key evidence that they present (in Table 3 of their article) is reproduced in Table 1 here. Their model I can be represented by the equation below, where \( F_{ijk} \) is the expected frequency of the \( ijk \)-th cell, \( \lambda \) is the grand mean, and \( \lambda^G_i \), \( \lambda^P_j \), and \( \lambda^C_k \) are the main effects of grandparents’ class, parents’ class, and children’ class, respectively. We call this the ‘main effects’ model (ME). ME precludes all two-way associations, and with a deviance \( G^2 \) of 15,425.7 for 324 degrees of freedom, it clearly fails to fit the data.

\[
\log F_{ijk} = \lambda + \lambda^G_i + \lambda^P_j + \lambda^C_k \quad \text{(ME)}
\]

Their model IV is the conditional independence model (CI), which takes into account the association between the class positions of grandparents and parents (represented by the \( \lambda^{GP}_{ij} \) term) and the association between the

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Table 1 Goodness of fit statistics of three loglinear models reported in Erola and Moisio (2007: Table 3)

<table>
<thead>
<tr>
<th>Model</th>
<th>G²</th>
<th>Df</th>
<th>rG²</th>
<th>Δ</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (ME) G, P, C</td>
<td>15425.7</td>
<td>324</td>
<td>—</td>
<td>17.1</td>
<td>11874.3</td>
</tr>
<tr>
<td>IV (CI) GP, PC</td>
<td>750.7</td>
<td>252</td>
<td>0.94</td>
<td>3.8</td>
<td>—2011.4</td>
</tr>
<tr>
<td>IX (FI) GP, PC, GC</td>
<td>296.4</td>
<td>216</td>
<td>0.97</td>
<td>2.0</td>
<td>—2071.0</td>
</tr>
</tbody>
</table>

Note: Roman numerals refer to model numbers in Erola and Moisio (2007: Table 3); rG² refers to proportional reduction in G² as compared with model I (ME).

class positions of parents and children (λ^PC). CI further posits that, conditional on the grandparents–parents association and the parents–children association, there is no net grandparents–grandchildren association. (Note the absence of the λ^GC term in CI.) This model also fails to fit the data (G² = 750.7 for 252 degrees of freedom, P < 0.001). But CI accounts for 94 per cent of the G² under ME, and the index of dissimilarity, Δ (i.e. the percentage of misclassified observations), comes down from 17.1 to 3.8.

$$\log F_{ijk} = \lambda + \lambda_i^G + \lambda_j^P + \lambda_k^C + \lambda_{ij}^{GP} + \lambda_{jk}^{PC}$$ (CI)

EM then add the λ^GC term, representing the grandparents–grandchildren association, to their analysis. The resulting model, which can be called the ‘full GC interaction model’ or FI, still does not fit the data. But compared with CI, G² is reduced by 454.3 for 36 degrees of freedom, which is a highly significant improvement in model fit. In other words, there is strong evidence against the null hypothesis of no net GC association. Furthermore, BIC would also suggest choosing FI over CI.

$$\log F_{ijk} = \lambda + \lambda_i^G + \lambda_j^P + \lambda_k^C + \lambda_{ij}^{GP} + \lambda_{jk}^{PC} + \lambda_{jk}^{GC}$$ (FI)

So how do EM come to the view of ‘almost conditional independence’? The discussion in their article suggests that they have abandoned the likelihood ratio test as a model selection criterion, and have instead relied on the index of dissimilarity and rG² (which is simply the proportional reduction in G² as compared with that of ME). To be clear, EM have reported the G² of their models, so that the fit of each model with the data can be assessed. But when it comes to comparing nested models, they have not used the likelihood ratio test. For example, they justify their choice of CI over FI as follows: ‘[c]ompared to model IV, the dissimilarity index is reduced from 3.8 to 2.0 and rG² from 0.94 to 0.97. This suggests that GC associations play a rather small role after controlling GP and PC’ (Erola and Moisio, 2007: p. 177).

EM’s model selection strategy seems inappropriate to us. This is so, firstly, because there is no theoretical basis in using rG² as a model selection criterion. As regards the index of dissimilarity, although it certainly has its role in the assessment of model fit, it is meant to be used ‘as a supplement to, rather than a replacement for, model-selection criteria such as those based on the log likelihood’ (Kuha and Firth, 2010: p. 375). Furthermore, even if we were to compare CI and FI on EM’s terms, it should be noted that λ^GC accounts for almost half (1.8/3.8) of the misclassified cases of CI, and 60 per cent of its rG² (454.3/750.7). Given these considerations, the conclusion of ‘almost conditional independence’ seems to us as unjustified.

We note that the qualifier ‘almost’ might provide some room for manoeuvre. This would be the case if the type I error associated with the null hypothesis of conditional independence is close to the conventional 5% cut-off, say, P ≈ 0.04. But for 36 degrees of freedom, the probability that a reduction in G² of 454.3 is due to chance is vanishingly small (P = 7.7 × 10⁻⁷⁴), rendering the qualifier unconvincing.

Large N and Model Selection Criterion

It is not unreasonable to argue that because the Finnish mobility table has a large number of observations (N = 57,585), almost all null hypotheses related to this table would be rejected by conventional statistical criteria, even if they make a lot of sense in substantive sociological terms. It then follows that some other model selection criterion should be used instead. Indeed, this is the motivation of Kuha and Firth (2010) when they propose the index of dissimilarity as a basis for model selection.

To address this concern, we have randomly drawn 20 subsamples from the Finnish data, each with 5,000 cases. Table 2 reports the G² of CI and FI when these two models are applied to the subsamples. It can be seen that the difference in G² between CI and FI, i.e. ΔG², ranges from 52 to 92. For 36 degrees of freedom, the improvement in fit of FI over CI is statistically significant in all 20 cases. In other words, the likelihood ratio test consistently and often strongly favours FI over CI, even when the sample size is much smaller. The strong evidence against the null hypothesis of conditional independence reported in Section 2 is not due to the large N of the Finnish data alone.
The Strength of Net GC Association

It could be argued that although the net GC association is statistically significant, it might not matter much in a substantive sociological sense. To address this question, we need to assess the strength of the net grandparents effect in social mobility. Specifically, we compare the expected outflow mobility rates under CI and FI in partial parents–children tables (stratified by grandparents’ class). Outflow mobility rates refer to the distribution of grandchildren according to their own social class given their class of origin (i.e. parents’ social class) and, in the present case, also stratified by grandparents’ class. In other words, they are the row percentages in partial mobility tables where parents’ class is the row variable, children’s class is the column variable, and grandparents’ class is the stratifying variable. There are many such outflow rates that we could report. But, as illustrations, Figure 1 reports the retention or immobility rates (with 95% confidence intervals) of those from salariat (class I + II) or unskilled working class (VIIa) origin.

Figure 1 Outflow rates under CI and FI (with 95% confidence intervals) compared with observed rates

Table 2 Deviance of CI and FI for 20 random subsamples (N = 5,000 each)

<table>
<thead>
<tr>
<th>Sample</th>
<th>$G^2$(CI)</th>
<th>$G^2$(FI)</th>
<th>$\Delta G^2$</th>
<th>$P$</th>
<th>Sample</th>
<th>$G^2$(CI)</th>
<th>$G^2$(FI)</th>
<th>$\Delta G^2$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>316.6</td>
<td>235.3</td>
<td>81.4</td>
<td>0.000</td>
<td>11</td>
<td>331.3</td>
<td>247.7</td>
<td>83.6</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>283.0</td>
<td>202.0</td>
<td>81.0</td>
<td>0.000</td>
<td>12</td>
<td>292.8</td>
<td>219.5</td>
<td>73.3</td>
<td>0.000</td>
</tr>
<tr>
<td>3</td>
<td>292.9</td>
<td>207.8</td>
<td>85.1</td>
<td>0.000</td>
<td>13</td>
<td>268.4</td>
<td>195.0</td>
<td>73.3</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>293.5</td>
<td>235.8</td>
<td>57.6</td>
<td>0.012</td>
<td>14</td>
<td>264.8</td>
<td>213.2</td>
<td>51.6</td>
<td>0.044</td>
</tr>
<tr>
<td>5</td>
<td>255.8</td>
<td>198.3</td>
<td>57.5</td>
<td>0.013</td>
<td>15</td>
<td>275.3</td>
<td>197.4</td>
<td>77.8</td>
<td>0.000</td>
</tr>
<tr>
<td>6</td>
<td>323.9</td>
<td>249.7</td>
<td>74.2</td>
<td>0.000</td>
<td>16</td>
<td>296.6</td>
<td>227.5</td>
<td>69.1</td>
<td>0.001</td>
</tr>
<tr>
<td>7</td>
<td>303.1</td>
<td>246.7</td>
<td>56.5</td>
<td>0.016</td>
<td>17</td>
<td>285.1</td>
<td>192.7</td>
<td>92.4</td>
<td>0.000</td>
</tr>
<tr>
<td>8</td>
<td>321.9</td>
<td>237.4</td>
<td>84.5</td>
<td>0.000</td>
<td>18</td>
<td>297.9</td>
<td>209.8</td>
<td>88.1</td>
<td>0.000</td>
</tr>
<tr>
<td>9</td>
<td>297.7</td>
<td>214.2</td>
<td>83.5</td>
<td>0.000</td>
<td>19</td>
<td>262.7</td>
<td>194.2</td>
<td>68.5</td>
<td>0.001</td>
</tr>
<tr>
<td>10</td>
<td>258.0</td>
<td>183.1</td>
<td>74.9</td>
<td>0.000</td>
<td>20</td>
<td>296.9</td>
<td>242.4</td>
<td>54.5</td>
<td>0.025</td>
</tr>
</tbody>
</table>

Note: $\Delta G^2 = G^2$ (CI) – $G^2$ (FI).
parents are expected to be immobile, irrespective of grandparents’ social class. But there is a good deal of variation in the observed immobility rates: from 50 per cent for those with salariat grandparents to 40 per cent for those with grandparents in the skilled manual class (V + VI). And consistent with the fact that FI is a better fitting model than CI, the observed rates tend to be closer to the expected rates under FI than to those under CI. Furthermore, while the observed rates are all within the confidence intervals of the relevant expected rates under FI (see the solid line segments), only three of them, pertaining to individuals with classes III, IVab, or VIIa grandparents, are within the confidence intervals of the relevant expected rates under CI.

Turning to the right panel of Figure 1, CI predicts that, regardless of grandparents’ class background, 26 per cent of Finns with unskilled working-class parents will stay in class VIIa. But there is considerable variation in the observed rates: from 22 per cent of those with class IVC grandparents to 34 per cent of those with class III grandparents. Also, the observed rates are closer to the expected rates under FI than to those under CI. Finally, the observed rates are all within the confidence intervals of the relevant expected rates under FI (the solid line segments). But only two observed rates, pertaining to those with class I + II or class VIIb grandparents, are within the confidence intervals of the relevant expected rates under CI.

Turning to the right panel of Figure 1, CI predicts that, regardless of grandparents’ class background, 26 per cent of Finns with unskilled working-class parents will stay in class VIIa. But there is considerable variation in the observed rates: from 22 per cent of those with class IVC grandparents to 34 per cent of those with class III grandparents. Also, the observed rates are closer to the expected rates under FI than to those under CI. Finally, the observed rates are all within the confidence intervals of the relevant expected rates under FI (the solid line segments). But only two observed rates, pertaining to those with class I + II or class VIIb grandparents, are within the confidence intervals of the relevant expected rates under CI.

The Pattern of the Net GC Association

Given the strong evidence against conditional independence, there is a need to specify just what the net grandparents effect looks like. To be fair, EM have fitted three further models doing just that. These are topological models, all nested within FI, and each specifies a particular constrained form of the net GC association. EM refer to them as ‘quasi-perfect mobility’ (QPM), ‘immobility due to lagged inheritance’ (ILI), and ‘lagged barriers of mobility’ (LBM), respectively (see models VI, VII, and VIII of their Table 3). Briefly, QPM fits a separate parameter for each of the diagonal cells of the partial GC mobility table; ILI replaces those seven parameters with just one parameter, contrasting the diagonal cells of classes I + II and IVC against the rest of the mobility table; finally, LBM highlights mobility from classes III, V + VI, VIIa, and VIIb to classes I + II, IVab, and IVC.8

Because these three models are nested within FI, their fit with the data could be compared with that of FI using the likelihood ratio test. For example, EM report that their model VIII (i.e. ILI + LBM) has a $G^2$ of 546.8 for 250 degrees of freedom. Compared with FI, $\Delta G^2 = 250.4$, $\Delta df = 34$, $P<0.001$. This suggests that although ILI + LBM is a lot more parsimonious than FI, much of the net GC association in the data is not captured by this model. The same is true for their models VI (i.e. QPM) and VII (i.e. ILI).9 EM maintain that ‘[a]lmost all (relative) mobility in the three-generation mobility table can be explained as a Markovian process’ (Erola and Moisio, 2007: p. 178). They also describe the two lagged effects that they identify (i.e. ILI and LBM) as ‘weak’ (p. 169). We note that EM have not reported the magnitude of the ILI and LBM parameters in their article. But even if they are indeed small effects, this does not support EM’s main claim of ‘almost conditional independence’, as the ILI + LBM model fails to capture much of the net GC association.

Conclusion

Erola and Moisio (2007: p. 169) argue that in Finland ‘[a]fter controlling for parents’ social class, the grandchildren’s social class is almost conditionally independent from the grandparents’ social class’. We have shown that this claim is not supported by the results reported in their own article. We also demonstrate that the strong evidence against conditional independence is not due to the large $N$ of the Finnish mobility table alone. We then present evidences that the grandparents effect matters for quantities of substantive interest, such as outflow mobility rates. Finally, we show that the ‘weak lagged grandparents effects’ identified by EM fail to capture much of the net GC association. Thus, their posited ‘weakness’ does not support EM’s main claim. Overall, then, our view is that EM’s main conclusion is unwarranted. There is indeed a net grandparents effect in social mobility over three generations in Finland.

Notes

1 EM use the CASMIN class schema (Erikson and Goldthorpe, 1992). In their article, EM have also modelled a four-way contingency table of grandparents’ class (G), parents’ class (P), children’s class (C), and lineages (L), where L represents the eight combinations of grandparents’, parents’, and children’s gender. As their analysis of this four-way table is similar to that pertaining to the three-way table, we will not discuss that section of their article. In addition to loglinear analysis, EM also regress
children’s ISEI score on those of parents and grandparents. Their OLS regression analysis shows that grandfathers’ status is consistently a significant predictor of grandchildren’s ISEI score, even when parents’ status is controlled for (see Erola and Moisio, 2007: Table 5). They note that ‘the [grandfather] effect exists, but it is very small. The result is line with the result achieved with loglinear models’ (p.179).

2 BIC refers to the Bayesian Information Criterion, and is given by the following expression: $\text{BIC} = \frac{G^2}{\text{df}} - \log N$ (see e.g. Raftery, 1986).

3 Private correspondence between the authors and Jani Erola confirms this.

4 We are grateful to Bent Nielsen for suggesting an expression to compute this $P$-value.

5 The Finnish mobility data is taken from The Finnish Longitudinal Census Data file, which was supplied by Statistics Finland to Jani Erola of the Department of Social Research, University of Turku. The three-generation mobility table is available at Jani Erola’s website, see http://users.utu.fi/japeer/data/.

6 All models in this article are fitted with the R package gnm (Turner and Firth, 2011).

7 Jani Erola confirmed in private correspondence with us that he obtained similar results with subsamples of Finnish data. He has provided some codes to draw subsamples from the Finnish mobility data, see http://users.utu.fi/japeer/script-codes.

8 That is, the following cells of the partial GC table is set at one fluidity level: III – I + II, III – IVab, III – IVc, V + VI – I + II, V + VI – IVb, V + VI – IVc, VIIa – I + II, VIIa – IVb, VIIa – IVc, VIIb – I + II, VIIb – IVab, VIIb – IVc, while the rest of the mobility table is set at another fluidity level, see Appendix 1 in Erola and Moisio (2007).

9 Comparing QPM with FI, $\Delta G^2 = 344.8$, $\Delta df = 29$, $P < 0.001$; as regards the comparison between ILI and FI, $\Delta G^2 = 370.6$, $\Delta df = 35$, $P < 0.001$.

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References


