# Qualified Equal Opportunity and Conditional Mobility: Gender Equity and Educational Attainment in Canada

Gordon Anderson*
University of Toronto

Teng Wah Leo†‡
St. Francis Xavier University

Robert Muelhaupt
University of Toronto

March 15, 2008

**Abstract**

"Equalizing opportunities"and "leveling playing fields", policy objectives aiming to make outcomes independent of circumstance, underly the interest in generational mobility. However there is little empirical evidence that such policies have ever been effective in terms of that aim. Here it is shown that, absent any other policy objective, pure equal opportunity policies are symmetric in effect, that is while increasing upward mobility of those poor in circumstance they have the unfortunate concomitant of increasing the downward mobility of those rich in circumstance. The addition of a pseudo "Paretian-Utilitarian"policy imperative (That the inheriting generation should not be made worse off in a first order stochastic dominance sense) yields a "Qualified Equal Opportunity" or "Conditional Mobility"policy. Such policies are asymmetric in effect focusing on improving the mobility of the poorly endowed without diminishing the opportunities of the richly endowed. Their empirical assessment requires that generational mobility relationships be viewed in a different light since post policy outcomes will not in general be completely independent of circumstance and should not be evaluated against that metric. In terms of generational regression models they

*Department of Economics, University of Toronto. Email Address: anderson@chass.utoronto.ca

†Department of Economics, St. Francis Xavier University. Email Address: tleo@stfx.ca

‡We wish to thank seminar participants at the University of Toronto, and Mount Allison University for their helpful comments and suggestions.

"convexify"the relationship (a structure frequently observed empirically) and induce a particular form of heteroskedastic error structure. In terms of Markov transition matrices they generate structures quite different from those characterized by independence. These ideas are explored in the context of Gender Equity in Educational attainment in Canada for cohorts born between the 1920's and the 1970's. The results are consistent with a Qualified Equal Opportunity program with the exception of the very poorest segment of society.

# 1 Introduction

> "*The conception of social justice held by many, perhaps most, citizens of the Western democracies is that of equality of opportunity. Exactly what that kind of equality requires is a contested issue, but many would refer to the metaphor of `leveling the playing field´, or setting the initial conditions in the competition for social goods as to give all, regardless of their backgrounds an equal chance of achievement. A central institution to implement that field leveling is education, meaning education that is either publicly financed or made available to all at affordable costs.* "John Roemer (2006)

With roots in recent egalitarian political philosophy[1] the Equal Opportunity Imperative sees differential outcomes as ethically acceptable when they are the consequence of individual choice and action but not ethically acceptable when they are the consequence of circumstances beyond the individual's control. Since a large portion of an individual's circumstances have to do with their gender and the parents they were blessed with, equal opportunity policies have to address the extent to which a child's status when adult is related to their gender and the status of their parents at a similar stage in their life cycle. As Kanbur and Stiglitz (1986) observed, in essence the issue is one of generational mobility (or the lack of it) and the way that it engenders a dynastic aspect to poverty and wealth over generations. The Imperative has engendered considerable empirical interest in the extent of generational mobility (or the degree to which a child's parental circumstance conditions it's outcomes), however evidence for complete mobility (independence of outcome from circumstance) is at best mixed (see for example Corak (2004) and references therein).

When Equal Opportunity is not the sole imperative there would probably be trade-offs or qualifications for the policy maker to consider. Piketty (2000) noted as much in his interpretation of the conservative - right wing view that, if generational mobility is low (because of the high heritability of ability) and the distortionary costs of welfare redistributions are high, it is reasonable to argue that low mobility is acceptable[2]. Friedman (2005) argues the other side of this coin in conjecturing (with a considerable amount of supporting evidence)

[1]See Arneson (1989), Cohen (1989), Dworkin (1981a), Dworkin (1981b) and Dworkin (2000).

[2]Indeed the pursuit of an equal opportunity goal has not been unequivocal, Cavanagh (2002) expresses some philosophical reservations, Jencks and Tach (2006) question whether an equal opportunity imperative should require the elimination of "..all sources of economic resemblance between parents and children. Specifically..(it)..does not require that society eliminate the effects of either inherited differences in ability or inherited values regarding the importance of economic success relative to other goals.". In a similar vein

that economic growth has facilitated the equalizing of opportunities (amongst other improvements in social justice) in effect allowing the poor to catch up without disadvantaging the rich.

If other societal aspirations are at play in mediating the complete mobility objective, then societies may be distinguished by the extent to which equal opportunity is the only or primal policy goal. In essence Erikson and Goldthorpe (1992) dispute this arguing that the sole tension between Liberal and Marxist theories of societal mobility is purely empirical. They argue that both sides agree on the ethical desirability of high mobility, but dispute whether it is or not empirically, with the Liberals claiming that it is high and rising (due to efficient resource allocation) and the Marxists claiming that it is not (due to class reproduction). Here this view is contested, a distinction between Liberal and Marxian aspirations for greater generational mobility is drawn and the notion that their respective desires for mobility are similar is disputed. In essence the Marxian mobility aspiration is based upon an objective of destroying inherited class, it does not necessarily come with any concern for overall economic wellbeing. It is a desire to break the connection between all parent and child outcomes and involves breaking the "good"connects (productive parents producing productive kids) as well as "bad"connects (unproductive parents producing unproductive kids). Breaking good connects and breaking bad connects are equally important and "extreme"communal policies such as separating children from their parents reflect these aims and the fact that the wellbeing costs of breaking the parent-child connects are not deemed too high to increase mobility under such regimens[3]. As such the Marxian policy would be an unqualified transformation of the joint distribution of outcomes and circumstances to one which reflects independence between the two. The success or failure of such policies is readily evaluated with statistical techniques which reflect degrees of dependence.

It is much more difficult to associate a common value to "breaking good connects"and "breaking bad connects"with Liberal aspirations. As a matter of casual empiricism, equal opportunity programs observed in "liberal"societies, generally of an affirmative action flavor, reveal a predominant concern with breaking "bad"connects. They tend to focus on

Dardanononi, Fields, Roemer, and Puerta (2006) question how demanding the pursuit of equal opportunity should be in terms of the feasibility of such a pursuit.

[3]It would be wrong to associate extreme attempts at breaking generational connects solely with Marxian regimes. The eugenics movement of the $20^{th}$ century was an attempt at breaking such connections, and eugenic sterilizations continued in the United States, Scandinavia, Switzerland, Canada (Alberta) up to 1970's and China's Law on Maternal and Infant Health Care was enacted in 1995.(Gillham 2001)

improving the life chances of the "inherited poor" rather than diminishing the life chances of the "inherited rich". In focusing only on elevating the prospects of the poorly endowed the liberal policymaker is in effect responding to a second imperative, a sort of Pareto condition wherein the lot of the poorly endowed is improved without diminishing the lot of the richly endowed. Indeed just breaking the bad connects elevates overall wellbeing which may be construed as the liberal policymaker following a Utilitarian mandate. In essence increased mobility of those poor in circumstance is revealed to have greater societal value than increased mobility of those rich in circumstance (which in the face of constraints will almost by definition be increased downward mobility which lowers aggregate material wellbeing). Furthermore, in terms of societal wellbeing, consuming resources in disinheriting the well endowed (or destroying inherited human capital) can be seen as doubly perverse and the concomitant distortionary wellbeing costs considered too high.

If the liberal policy maker does indeed follow the dual mandates of equal opportunity and a utilitarian outcome, a qualified equal opportunity program emerges with asymmetric mobility aspirations for increasing the mobility of the poorly endowed and not increasing the mobility of the well endowed when it involves a loss of their wellbeing. The extent to which these objectives are fulfilled is bounded by the capacity in the system. Such "liberal" policies can no longer be characterized as unqualified moves towards the independence of outcomes and circumstances for all classes as in the Marxian case. They are rather equivocal moves, modifying the joint distribution of outcomes and circumstances differentially toward independence for the poor in circumstance and independence for the rich in circumstance only if their material wellbeing is unaffected. Evaluating their success or failure requires rethinking the way current empirical mobility measures (generational regression coefficients and transition matrix structures) are used and interpreted since generally they attach equal weight to both the poor and rich in circumstance.

This paper addresses these issues. In Section 1 it is formally shown that, when the policy maker faces the "Paretian" constraint of not making the children of specific income groups materially worse off under an equal opportunity policy, a qualified equal opportunity policy emerges. The extent to which this can be achieved is limited by the degree of flexibility in the system (represented in the model presented by potential growth, much along the lines of Friedman (2005)). Mobility improvements are qualified by their circumstance source in some sense and implications for the way in which such mobility is measured are developed. A means of evaluating the success of mobility policies differentially is developed in Section 2 where a "Qualified"or Conditional Mobility measure is proposed which is simple to employ and permits the identification and examination of group specific mobility changes in the sense that the mobility of the poor or rich in circumstance can be addressed separately. Implications for the way in which conventional measures of mobility are used and interpreted are also examined.

To illustrate the concepts and their measurement, Statistics Canada's General Social Survey cycle 19 (2005) is used to examine the closing gender gap in educational attainment that occurred in Canada (Blau, Brinton, and Grusky 2006).[4] One of the preoccupations of Sen's considerable body of work on social justice is the achievement of "gender justice"(See Nussbaum (2006), Sen (1990), Sen (1995) for example). This could have been achieved quite swiftly by a transfer of resources from the investments in male human capital to investments in female human capital. Had that been so, an improvement in the achievements of females accompanied by deterioration in the achievements of males would have been observed. However it will be shown that, while male academic achievements did not deteriorate, the narrowing gender gap is characterized by an increased generational mobility of women relative to men. Furthermore the source of this increased mobility was the daughters of parents with lower educational attainments (which may be construed as a "good"since it implies upward mobility) rather than the daughters of parents with high educational attainments (which may be construed as a "bad"since it implies downward mobility and the attrition of inherited wellbeing). Indeed it appears that the increased mobility of women has come about as a consequence of a reduction in the dependence of their attainment outcomes on those of their mothers especially at the lower end of the maternal attainment spectrum. However increasing immobility was observed in the lowest inheritance class.

## 2 The Constrained Equal Opportunity Imperative

To illustrate matters, consider a simple generational income class transition structure where parental incomes $x = 1, 2, 3, 4$ transit to child incomes $y = 1, 2, 3, 4$. The marginal probability that a child is in income class $i$ is given by the vector $c(y)$, the probability that a parent is in class $i$ is given by the vector $p(x)$ and the joint distribution of parent child incomes is given by the matrix $J(y, x)$ where:

[4] This phenomena has also been observed in the United States see Buchmann and Diprete (2006), Dynarski (2007), Goldin, Katz, and Kuziemko (2006) and Jacob (2002).

$$\Pr(y = i \cap x = j) = J\,(y,x) = \begin{bmatrix} j_{1,1} & j_{1,2} & j_{1,3} & j_{1,4} \\ j_{2,1} & j_{2,2} & j_{2,3} & j_{2,4} \\ j_{3,1} & j_{3,2} & j_{3,3} & j_{3,4} \\ j_{4,1} & j_{4,2} & j_{4,3} & j_{4,4} \end{bmatrix}$$

$$c(y) = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \end{bmatrix} \quad p(x) = \begin{bmatrix} p_1 \\ p_2 \\ p_3 \\ p_4 \end{bmatrix}$$

with $c_i = \sum_{k=1}^{4} J_{i,k}$ and $p_i = \sum_{i=1}^{4} J_{i,k}$, where $i,\ k = 1,2,3,4$. Letting $P = Diag(p(x))$, the conventional transition matrix $T$ is written as $T = J(y,x)P^{-1}$ whose $i^{th}$, $k^{th}$ element is $P(y = i|x = k)$ and yields the child's income class vector $c(y)$ from the equation $c = Tp$. An equal opportunity environment $J^*$ would be one where $J^* = c(y)p(x)'$, i.e. independence between child and adult outcomes which yields a transition matrix with common columns $c(y)$ reflecting the fact that a child's life chances are the same for all parental classes. Average child and adult incomes are given by $c(y)'y$ and $p(x)'x$ respectively, when child outcomes are positively correlated with adult outcomes the conditional distribution of the outcomes of children with low income parents will be stochastically dominated by that of higher income parents so that, in its strongest form:

$$\sum_{i=1}^{m} (J_{i,j} - J_{i,k}) \geq 0 \text{ for } j < k;\ j,\ k,\ m = \{1, ..., 4\}$$

An equal opportunity program is one which moves a joint density $J$ toward $J^*$. First note that a move toward $J^*$ that preserves the child socioeconomic status structure (keeps $c$ unchanged), will make the children of one parental income group worse off while making the children of another better off. Since $J^* = cp'$ and noting that $T^*p = Tp$, suppose $J \neq J^*$ in that for a given socioeconomic group $q$, if the group does not exhibit independence in the status quo, then for some child outcomes $k \neq i$, $j_{i,q} = c_i p_q$ and $j_{k,q} = c_k p_q$, since the marginals must always sum to one for each socioeconomic group. Further since the marginals of child outcomes must also sum to one, $j_{i,l} = c_i p_l$, and $j_{k,l} = c_k p_l$, for child outcomes for some $l \neq q$. If $k < i$ then:

$$\sum_{i=1}^{m} \frac{\left(J^*_{i,q} - J_{i,q}\right)}{p_q} \geq 0 \text{ for } m = \{1,2,3,4\} \text{ and}$$
$$\sum_{i=1}^{m} \frac{\left(J^*_{i,l} - J_{i,l}\right)}{p_l} \leq 0 \text{ for } m = \{1,2,3,4\}$$

So that children from $q^{th}$ income parents will be worse off (in the sense that their children's outcome distribution in the status quo state first order dominates that of the equal opportunity distribution) and children from $l^{th}$ income parents will be better off by the move to equal opportunity (in the sense that the children's outcome distribution in the status quo state is first order dominated by that of the equal opportunity distribution).

Consider a planners problem; she wants to promote equal opportunity but does not want the outcomes for children in any parental income class to deteriorate. She takes the existing parental income distribution to be fixed and immutable. Let $J^0$ correspond to the existing (i.e. pre-policy) transition matrix $T^0$ which actually yields $c^0$ with an average child income of $c^{0\prime}y$ and let $J^1$ correspond to the post policy transition matrix $T^1$ which could yield an average child income of as much as $c^{0\prime}y + g$. In effect $y'J^1p \leq c^{0\prime}y + g$ is a constraint on the possible choices of $J^1$ for generally, as demonstrated above, when $g$ is 0 no move of $J^0$ toward an equal opportunity structure is possible without making the children of at least one parental income group worse off. Equal Opportunity corresponds to $J^1 = c^1p'$ (note that given $p'$, the $c^1$ that exhausts the growth constraint is known) and suppose that $J^0 \neq c^0p'$ and in addition a utilitarian constraint exists such that the rows of $J^1$ must stochastically dominate the corresponding rows of $J^0$ at some order (assume it to be the first) following the notion that the young generation should not be made worse off by the equal opportunity policy. That is the new conditional density (conditional on the child's socioeconomic status) must first order stochastically dominate the status quo conditional density.

Next note that with an objective of growth in child outcomes, $\sum_{i=1}^{4}(c_i^* - c_i^0)$, subject to three stochastic dominance criterion of $\sum_{i=1}^{q} c_i^* \leq \sum_{i=1}^{q} c_i^0$, $i = \{1,2,3\}$, and that $\sum_{i=1}^{4} c_i^* = 1$, the density vector of child outcomes, $c^*$, is completely determined. This optimal vector then serves as the target for independence and, assuming all unit changes in the joint density are equally costly, the planner's problem may be written as:

$$\min_{J^1} \sum_{i=1}^{4}\sum_{k=1}^{4}\left(j_{i,k}^1 - c_i^* p_k\right)^2$$

and she chooses the joint density of parent-child outcomes subject to the following constraints,

$$\sum_{i=1}^{l}\left(j_{i,k}^1 - j_{i,k}^0\right) \leq 0$$

$$\sum_{i=1}^{4} i\left(\sum_{i=1}^{4} j_{i,k}^1 - c_i^0\right) \leq g$$

$\forall k = \{1,2,3,4\}$, $l = \{1,2,3\}$, and where $\sum_{i=1}^{4} j_{i,k}^1 = p_k$, $\sum_{k=1}^{4} j_{i,k}^1 = c_i$, and $j_{i,k}^1 \geq 0$ $\forall i$ and $k$. That is she wants to ensure that in choosing the matrix of joint densities, children of each socioeconomic group do not suffer a fall in welfare, and that growth in child outcomes is met at the same time. The question of equal opportunity phrased in this form highlights the competing considerations.

Since $\sum_{i=1}^{4} j_{i,k}^1 = p_k$, we can rewrite the objective function as;

$$\min_{J^1} \sum_{i=1}^{3}\sum_{k=1}^{4} 2\left(j_{i,k}^1 - c_i^* p_k\right)^2 + \sum_{k=1}^{4}\left\{2\sum_{i=1}^{3}\left[(j_{i,k}^1 - c_i^* p_k)\sum_{l=i^-}(j_{l,k}^1 - c_l^* p_k)\right]\right\}$$

Similarly, the growth constraint can be simplified into

$$\sum_{i=1}^{3}(3-i)\left(c_i^0 - c_i^1\right) \leq g$$

The Lagrangian in terms of the unconstrained $j_{i,k}$'s for this problem may be written as:

$$L = \left\{ \begin{array}{l} \sum_{i=1}^{3}\sum_{k=1}^{4} 2\left(j_{i,k}^1 - c_i^* p_k\right)^2 + \sum_{k=1}^{4}\left\{2\sum_{i=1}^{3}\left[(j_{i,k}^1 - c_i^* p_k)\sum_{l=1, i\neq i}^{3}\left(j_{l,k}^1 - c_l^* p_k\right)\right]\right\} \\ +\sum_{k=1}^{4}\sum_{l=1}^{3}\lambda_{l,k}(j_{i,k}^1 - j_{i,k}^0) + \gamma\left[\sum_{i=1}^{3}(3-i)\left(c_i^0 - \sum_{k=1}^{4} j_{i,k}^1\right) - g\right] \end{array} \right\}$$

The resultant Kuhn Tucker conditions are:

$$\frac{\partial L}{\partial j_{r,l}^1} = 4\left(j_{r,l}^1 - c_i^*\right) + 2\sum_{q=1, q\neq l}^{4}\left(j_{q,l}^1 - c_q^* p_l\right) + \sum_{i=1}^{r}\lambda_{i,l} + \gamma\left(4 - r\right) = 0 \tag{1}$$

$$\frac{\partial L}{\partial \lambda_{r,l}} = \sum_{q=1}^{r}\left(j_{q,l}^1 - j_{q,l}^0\right) \leq 0 \qquad \lambda_{r,l} \geq 0 \tag{2}$$

$$\frac{\partial L}{\partial \gamma} = \sum_{i=1}^{3}(3-i)\left(c_i^0 - \sum_{k=1}^{4} j_{i,k}^1\right) - g \leq 0 \qquad \gamma \geq 0 \tag{3}$$

Where $r = \{1, 2, 3\}$, $l = \{1, 2, 3, 4\}$ When the constraints do not bind ($\lambda_{r,l} = 0$ for $r = \{1, 2, 3\}$, $l = \{1, 2, 3, 4\}$ and $\gamma = 0$) the solution to (1) is the equal opportunity solution $j_{i,k} = c_i^* p_k \forall i$ and $k$, but as the constraints successively bind the equal opportunity outcome is successively compromised with the solution being a combination of the initial and equal opportunity outcomes. Notice the solution for the richest unconstrained group ($l = 4$ in (1)) contains a compounding of the stochastic dominance shadow prices of each socioeconomic group, in essence not meeting the stochastic dominance constraint at the lowest socioeconomic level implies costs at all socioeconomic levels. Thus suppose the initial state is one of complete immobility ($c_i^0 = p_i \forall i = \{1, .., 4\}$) and $g > 0$[5]. The social planner would reallocate the $j_{1,j}$'s to the extent that (3) does not bind and (2) does not bind for $k = 1$. Thus mobility will be improved for the poorest children (note that increased mobility for the richest children would involve increased downward mobility making them worse of and conflicting with the dominance condition (2). Should there still be capacity for change the $j_{2,j}$'s would next be reallocated and so on until the growth constraint is exhausted or complete equality of opportunity is achieved.

## 3 Measuring Conditional or Qualified Mobility

Intergenerational mobility has often been examined via the regression coefficient ($\beta$) of a child's characteristic when adult ($y$) on the corresponding parental characteristic ($x$) (Solon 1992). In effect that literature interpreted $\beta$ as a mobility index, building upon Becker and Tomes (1979) to create a rich class of models highlighting the forces that determined the value of $\beta$, where it inferred mobility (equal opportunity) as $\beta \to 0$ and immobility (unequal opportunity) as $\beta \to 1$. The notion of Qualified Equal Opportunity induces a hypothesis of negative dependence of $\beta$ on the parental characteristic, and it also induces hypotheses about the conditional variance of child outcomes with respect to adult outcomes. This is best exemplified in a simple example. Suppose the pre and post qualified equal opportunity policy child-adult joint densities are $J^0$ and $J^1$ respectively, and were given by:

$$j^0 = \begin{bmatrix} 0.25 & 0 & 0 & 0 \\ 0 & 0.25 & 0 & 0 \\ 0 & 0 & 0.25 & 0 \\ 0 & 0 & 0 & 0.25 \end{bmatrix} \qquad j^1 = \begin{bmatrix} 0.125 & 0 & 0 & 0 \\ 0.125 & 0.25 & 0 & 0 \\ 0 & 0 & 0.25 & 0 \\ 0 & 0 & 0 & 0.25 \end{bmatrix}$$

In the pre policy state the generational regression has a coefficient of one (complete immobility) and a conditional variance of 0. The move toward independence between child and adult outcomes at low adult outcome levels induces a convex non-linearity in the generational regression at the low income level, flattening out the regression line there (much as is observed in the results in Bratsberg, Roed, Raaum, Naylor, Jantti, Eriksson, and Osterbacka (2007)). In addition, for the low parental income group, the conditional variance

[5]Recall that if $g$ were 0 no move toward an equal opportunity policy could be made without making some of the children in at least one of the income classes worse off.

of child outcomes will be greater than the pre policy outcome (0.25 as opposed to 0) and greater than at higher levels of income where greater dependence between child and adult outcomes will be exhibited. This suggests that, in addition to a falling $\beta$, the residuals in a generational mobility regression should exhibit increased negative dependence on the parental status variable as a consequence of an increased mobility policy.

Since Atkinson (1983) there has been interest in the nonlinearity of generational income elasticity or asymmetry of mobility[6], largely stimulated by Becker and Tomes's (1986) conjecture that child-adult outcome relationships are concave due to asymmetries in borrowing constraints. Presumably theories of diminishing returns to human capital transfer and regression to the mean would also produce a similar conjecture. However here it is suggested that, whatever the initial generational regression relationship, a qualified equal opportunity program would "convexify"it and increase the extent to which conditional heteroskedasticity of the child outcome is negatively related to adult income. It should be noted that an unqualified equal opportunity program would yield child outcomes that are homoskedastic with respect to adult incomes.

Mobility interpretations of $\beta$ are to some extent limited by its connection to the correlation coefficient $\rho_{yx}$ ($\beta = \rho_{yx}(\frac{\sigma_y}{\sigma_x})$), and that statistic's ability to reflect dependence, they are further circumscribed by the degree to which the $y$ and $x$ relationship is homogeneously linear across all strata of the characteristic in question.

Alternatively the transition matrix between the common quantiles of the marginal distributions $p(x)$ and $c(y)$ can be more informative as to the nature of the dependence when it is non-linear. This has given rise to the application of techniques derived from Markov Chain processes and the development of mobility indices, some based upon the nature of the transition matrix directly, some based upon other concepts[7] all of them reflecting to varying degrees the extent to which $x$ and $y$ are independent. With complete mobility the columns of the transition matrix would be identical (corresponding to independence between parent and child outcomes) while with complete immobility the leading diagonal would equal 1.

---

[6]Behrman and Taubman (1990), Solon (1992), Mulligan (1999), Corak and Heisz (1999), Couch and Lillard (2004), Grawe (2004) and Bratsberg, Roed, Raaum, Naylor, Jantti, Eriksson, and Osterbacka (2007) all being examples.

[7]Bartholemew (1982), Blanden, Goodman, Gregg, and Machin (2004), Chakravarty (1995), Dearden, Machin, and Reed (1997), Hart (1983), Maasoumi (1986), Maasoumi (1986), Sig (1955), Shorrocks (1978), have all produced mobility indices many of which are discussed in Maasoumi (1996).

Here, following Anderson and Leo (2007), the degree of mobility is assessed via the joint distribution of $x$ and $y$ (namely $J(x, y)$) since such an approach is amenable to evaluating mobility conditional on particular ranges of $x$. The approach is founded upon the notion that if $x$ and $y$ are independent for a particular range of $x$ and $y$, say $a_x < x < b_x$ and $a_y < y < b_y$ then:

$$\int_{a_y}^{b_y}\int_{a_x}^{b_x} j(x,y)dxdy - \int_{a_x}^{b_x} p(x)dx \int_{a_y}^{b_y} c(y)dy = 0 \quad (4)$$

This relation provides the basis of the contingency table test which essentially examines whether or not $\Pr(a_x < x < b_x, a_y < y < b_y) = \Pr(a_x < x < b_x)\Pr(a_y < y < b_y)$ for collections $a^*$ and $b^*$ of $a$ and $b$ values which delineate mutually exclusive and exhaustive intervals the respective ranges of $x$ and $y$. In the present context the issue is whether joint probabilities of parent and child outcomes are equal to the products of the corresponding marginal probabilities.

An overall mobility index (Anderson and Leo 2007) may be constructed from a sum of the terms:

$$\min\left(\int_{a_y}^{b_y}\int_{a_x}^{b_x} j(x,y)dxdy, \int_{a_x}^{b_x} p(x)dx \int_{a_y}^{b_y} c(y)dy\right) \quad (5)$$

In this case the sum is taken over the respective collections $a^*$ and $b^*$. This index is a measure of the extent to which the empirical joint density and the joint density implied by independence, overlap or coincide. Such an index can be shown to be a number between 0 and 1, where 1 indicates complete independence (mobility), with lower values indicating relative dependence (immobility). The value of the statistic appears to be normally distributed asymptotically which facilitates simple statistical comparison of mobility states.

Note that condition (4) could be equally well written as

$$\frac{\int_{a_y}^{b_y}\int_{a_x}^{b_x} j(x,y)dxdy}{\int_{a_x}^{b_x} p(x)dx} - \int_{a_y}^{b_y} c(y)dy = 0 \quad (6)$$

This relation asks if the conditional probability of a child outcome given its parents outcome is equal to the marginal probability of the child's outcome. Conditional or qualified mobility may be examined by considering the sum of terms of the form:

$$\min\left(\frac{\int_{a_y}^{b_y}\int_{a_x}^{b_x} j(x,y)dxdy}{\int_{a_x}^{b_x} p(x)dx}, \int_{a_y}^{b_y} c(y)dy\right) \tag{7}$$

In this case the sum is taken over choices of $a_y$ and $b_y$ that exhaust the range of $y$. Such a statistic measures the proximity of the conditional distribution to its corresponding marginal distribution where the conditioning region is the range of the parental characteristic of interest. It has the same numeric and statistical properties as the overall mobility statistic outlined above and is more informative in the sense that mobility conditional upon a particular inherited circumstance can be examined. These techniques can be easily generalized to examine questions of the form does $j(w,x,y,z) = p(w,x) \times c(y,z)$ (see Anderson and Leo (2007)) so that in the present context the joint independence of child outcomes and parental circumstance can be considered.

# 4 An Example: Narrowing the Educational Gender Gap in Canada

One profound change in the latter part of the $20^{th}$ century was the emancipation of women and the declining significance of gender (Blau, Brinton, and Grusky 2006). The introduction of the pill, abortion rights and legislation against gender discrimination in the workplace improved the wellbeing and status of women in those years (Pezzini (2002); Goldin and Katz (2002); Siow (2002)). One dimension in which this found expression is in the narrowing gap in academic achievement of men and women (Dynarski 2007). To study this phenomenon in the light of a hypothesized qualified mobility mandate the educational achievements of successive cohorts of individuals and their parents are compared.

## 4.1 Summary of Data

The data on the academic achievements of children and their parents in Canada are drawn from Statistics Canada's General Social Survey cycle 19 (2005). Table 1 outlines a simple attainment index which associates integers 1 through 5 with the highest academic achievements of individuals aged 25 and above and their parents in 2005.

Table 2 summarizes the proportion of individuals in each educational attainment category, and the corresponding proportion of observations with their parents in those categories by the individual's gender and the cohort (decade) in which they were born. Note that for individuals born in the 1940s and earlier, the upper attainment levels are dominated by males, but this changes in favour of females in later cohorts, corresponding with the increased female participation in the post World War II decades. Note also that males also tended to have greater proportions of parents in the higher attainment levels.

Table 3, in presenting a comparison of male and female academic attainment distributions across the cohorts, highlights the turnaround in the academic achievements of males and females over time. Suppose "real"achievement, $A(y)$, is a function of the simple achievement index $y$, provided $A(y)$ is monotonically increasing in $y$ (which is distributed as $F(y)$ for females and $G(y)$ for males). A necessary and sufficient condition for $E(A(y))$ to be greater for males than females is $G(y) \leq F(y)$ for all $y$ with strict equality holding somewhere, the first order dominance criterion. For the cohorts born before 1940, with four significantly negative differences (at 5% level of significance) and no significantly positive differences. The male achievement distribution strongly first order dominates that of females for earliest cohorts. With one significantly negative difference and no significantly positive differences for cohorts born in the 1940's. For cohorts born in the 1950's there appears to be no significant differences in the male and female distributions. Two significantly positive entries and no significantly negative entries in the difference vector herald the reversal of the ordering of male and female attainment distributions in the 1960's with the female distribution now first order dominating the male distribution, a position which appears to have solidified in the cohorts born in the 1970's.

## 4.2 The Generational Regression Approach

In analyzing educational mobility in the context of generational regressions the model considered is of the form:

$$y_{i,k} = \alpha_k + \beta_{1,k} x_{i,k} + \beta_{2,k} x_{i,k}^2 + \epsilon_{i,k} \tag{8}$$

where $E(\epsilon_{i,k}) = 0$ and $E(\ln \epsilon_{i,k}^2) = \gamma + \phi x_{i,k}$ where $i = \{1, 2, ..., n_k\}$, $k = \{male, female\}$ Here $y$ corresponds to the child and $x$ the parent's outcome and heteroskedasticity is modeled in terms of the log squared error being a linear function of parental attainment. Note that what we are seeking here is not to interpret the variables' effect in their underlying nominal terms, i.e. number of years of education, but as ordinal variables to see how variances have changed across the cohorts, and by gender. The results are reported in tables 4 to 8. At the outset it should be noted that the generational transfer technology appears to be concave i.e. it appears to exhibit diminishing returns to parental ability.

Examining the coefficients of the main regression for all the cohorts, note first that for females, both maternal and paternal effects are highest for cohorts born between the 1930s and 1940s. The decline was faster from fathers than mothers, and by the final cohort, the parental effects are approximately half of that among those born in the 1930s. For males, the pattern is similar but more substantial, all of which are evidence of increased mobility across both gender. Examining the coefficient for heteroskedasticity in turn, note that all the coefficients were statistically significant with the exception of the 1950s cohort. Further, for both males and females, the maternal effect was stronger, and heteroskedasticity seem to be greatest among the 1950s, post World War II cohorts.

With respect to the Qualified Equal Opportunity Hypothesis, which predicts a declining concavity or "convexification"of the parent-child technology and an intensified monotonically decreasing error variance relationship with parental attainments as the cohorts get younger, the evidence is substantive. Tables 7 and 8 present the convexification and heteroskedasticity comparisons across the five cohorts (c1 corresponding to the youngest cohort and c5 the oldest). Through the five cohorts, there seem to have been a significant decline in concavity of the "production function", somewhat more pronounced for males than females. For males born in the 1970s, the quadratic term was in fact not significant. Similarly the heteroskedasticity parameter appears to have become substantially more negative except perhaps with respect to the most recent female cohort.

## 4.3 The Overlap Measure

If child outcomes and parental circumstances are independent, the Overlap Measure introduced in section 3 will record values close to 1. To the extent that they are not independent the statistic will record a value less than 1. The various results and comparisons are reported in tables 9 to 15.

Table 9 reports the overlap measure for each cohort by gender, and for the effect of each parent for all attainment levels (Joint parent-child educational outcome density)[8]. Interestingly, for the male child there seem to be a decline in the drive toward independence from the perspective of both maternal and paternal effects. This pattern is mimicked by female children as well, but notice the maternal effect continued its movement towards independence up till the cohort born in the 1960s. All measures are significantly different from 1 suggesting that a pure equal opportunity imperative has not been pursued or achieved. A final observation is that in general, maternal effects were greater than paternal, but are generally not significant with the exception of the male cohorts born in the 1960s and 1970s, and the 1960s cohort for female children. What is interesting is that the 1960s correspond with the high birth rates, while the 1970s saw a gradual fall, suggesting that the slight dip in overlap measure is a result of more time spent on each child in a period that saw strong economic growth.

Tables 10 and 11 report the cross cohort differences in table 9 by gender of the child. For female children, the mother-child joint density are not significantly different across the cohorts with the exception of the 70s vs 60s (which saw a weak decline), however comparisons of cohorts born in the 60s vs. 30s and 50s vs 30s showed significant increases in mobility. While the decline of father-child transmission across the cohorts are unanimously statistically not significant. For male children, generally the cross cohorts differential are not statistically significant with the exception of mother-child comparisons between 50s vs. 30s and 40s vs. 30s (improvement towards independence), and for father-child comparisons, between 50s vs. 70s, and 50s vs. 60s (both of which saw a decline in independence).

Generally the inferences that can be drawn from these aggregate or overall measures are relatively weak largely because they are aggregations. As such they conflate trends toward mobility in one segment of society with movements away from mobility in another. The comparison between the empirical conditional density of child attainment versus the unconditional marginal density, which is reported in table 12, will render a clearer picture of changes in mobility patterns. For female children, notice that the gradual movement towards an independence structure is principally driven by parents with high school diplomas, technical and trade education, and those with some college experience. The move towards independence is lowest among those with dropout parents and in fact rather perversely, it is declining, that is they are becoming more dependent! Further, the close correspondence between the attainments of daughters and college graduate parents seem to remain strong. For

[8]Observations with missing parental attainments have been dropped.

male children, a similar pattern reveals itself, although the movement towards independence does not seem to be as strong among parents with high school and trade diplomas, as well as parents with some college experience. Similarly, among parents with college education, the relative shift towards independence is far lower (Notice the maternal connection is strong among these children, both male and female based on the smaller increases in the overlap measure). The low intergenerational mobility among dropout parent children is similarly mimicked here.

The drive toward higher mobility can be examined by comparing cohorts within a particular parental attainment class, with successful policies rendering statistically significantly higher mobility measures with successively younger cohorts. From the perspective of the qualified equal opportunity nature of programs, the comparison should be between particular parental attainment groups within a particular cohort where such programs would result in statistically significantly lower mobility coefficients in higher attainment groups. These comparisons are reported in Tables 14 and 15 which look specifically at daughters of mothers and sons of fathers comparisons (the other comparisons did not differ in substance from these and have been omitted for space reasons).

From Table 13 observe that, excepting "Drop Out"Parents all of the significant changes across cohorts are increasing mobility changes, predominantly among children with "High School"parents (and then more so with females than males). There are a few significant increases among the daughters of "Tech Ed"parents but no significant mobility changes across cohorts in the children (of either gender) of University Graduates, all of which is consistent with a Qualified Mobility scenario. What is at odds with the Qualified Mobility Scenario is the significant reductions in mobility experienced by the younger cohorts in the "Drop Out"parent category. This suggests a forgotten segment of the populace that public policy has neglected. In the stylized model, it has implicitly been assumed that the cost of advancing children across the distribution is the same but in all probability this is not the case. A more appropriate model would explicitly include the cost to the social planner of shifting the different cells of a density. Intuitively, if the lower tail of the density is where the cost are the highest, then it is those children that could be left behind. The results of Table 15 reporting the within cohort across parental attainment category comparisons are equally supportive of a Qualified Mobility paradigm. Again excluding the "Drop Out"category, mobility is significantly higher in the lower attainment categories and is more so in the recent as compared to the older cohorts.

Finally a comparison of the qualified mobility of daughters of mothers with that of sons of fathers (Table 15) reveals that with one exception all of the significant differences relate to higher mobility of daughters in more recent cohorts. Furthermore the advances have taken place in the lower parental attainment categories. No significant differences were identified in the over 65 category and only one significant difference was observed in the 55-64 category. This signals the advances that females have made over males in the last half century.

# 5 Conclusions

It has been demonstrated that, in the absence of sufficient flexibility or capacity in a society, the unqualified pursuit of an equal opportunity goal results in some people being made worse of when others are made better off. If some sort of Utilitarian-Paretian goal is also an objective of the policy maker (in effect a maintenance of the status of the well endowed) in a constant cost world, a qualified equal opportunity outcome emerges in which the most disadvantaged are addressed first. With such an outcome, complete independence of outcome from circumstance will not be observed and conventional measures of mobility will not record complete mobility. However such policies have predictable consequences for generational regressions and suggest ways that mobility measures could be re-interpreted. Qualified equal opportunity policies will induce convexities in the prevailing generational regression relationship as well as inducing heteroskedasticity in the corresponding error process which is negatively related to the conditioning variable. Alternatively evaluating conditional mobility policies via the transition matrix or joint distribution of outcomes and circumstance requires indices which identify changes in mobility by subgroup or conditional mobility measurement.

To illustrate the concept and the associated indices the success of various equal opportunity policies pursued either implicitly or explicitly in the emancipation of women was evaluated in terms of how they narrowed the gender gap in educational attainment in Canada. Hypotheses relating to generational regressions that are consistent with a qualified equal opportunity program are not rejected for daughters whereas they are for sons. From the conditional mobility indices comparisons the gender gap appears to have been narrowed by an increase in the mobility of the daughters of parents of lower educational status without any change in the mobility of daughters or sons in other categories. All of which is what would have been expected from a Qualified Equal Opportunity or Conditional Mobility Policies.

It also appears that there is a segment of children, both males and females, of dropout parents whom society has neglected in that their mobility has diminished. It is conjectured that, contrary to what is implicitly assumed in the model here presented, the cost of improving the stead of the deprived are not the same as those associated with other better endowed segments of the populace. If those cost are significantly higher, the social planner would be less inclined to improve their mobility in the first instance.

# References


Anderson, G., and T. W. Leo (2007): "Child Poverty, Generational Mobility and the One Child Policy in Urban China," Mimeo University of Toronto, Department of Economics.

Arneson, R. (1989): "Equality and Equality of Opportunity for Welfare," *Philosophical Studies*, 56, 77–93.

Atkinson, A. (1983): *The Measurement of Economic Mobility in Social Justice and Public Policy*. Cambridge, MA.

Bartholemew, D. (1982): *Stochastic Models for Social Processes*. Wiley New York, 3 edn.

Becker, G., and N. Tomes (1979): "An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility," *Journal of Political Economy*, 87, 1153–1189.

——— (1986): "Human Capital and the Rise and Fall of Families," *Journal of Labor Economics*, 4, 1–39.

Behrman, J., and P. Taubman (1990): "The Intergennerational Correlation Between Children's Adult Earnings and their Parents Income: Results from the Michigan Panel Survey of Income Dynamics," *Review of Income and Wealth*, 36, 115–127.

Blanden, J., A. Goodman, P. Gregg, and S. Machin (2004): *Changes in Intergenerational Mobility in Britain*Cambridge University Press, in Generational Income Mobility in North America and Europe edited by Miles Corak.

Blau, F., M. Brinton, and D. Grusky (2006): *The Declining Significance of Gender?* Russell Sage Foundation.

Bratsberg, B., K. Roed, O. Raaum, R. Naylor, M. Jantti, T. V. Eriksson, and E. Osterbacka (2007): "Nonlinearities in Intergenerational Earnings Mobility: Consequences for Cross Country Comparisons," *Economic Journal*, 117, 72–92.

Buchmann, C., and T. Diprete (2006): "The growing Female Advantage in College Completion: The Role of Family Background and Academic Achievement," *American Sociology Review*, 71, 515–541.

Cavanagh, M. (2002): *Against Equality of Opportunity*. Clarendon Press.

Chakravarty, S. (1995): "A Note on the Measurement of Mobility," *Economics Letters*, 48, 33–36.

Cohen, G. A. (1989): "On the Currency of Egalitarian Justice," *Ethics*, 99, 906–944.

Corak, M. (2004): *Generational Income Mobility in North America and Europe*. Cambridge University Press.

Corak, M., and A. Heisz (1999): "The Intergenerational Earnings and Income Mobility of Canadian Men: Evidence from Longitudinal Income Tax Data," *Journal of Human Resources*, 34, 504–533.

Couch, K., and D. Lillard (2004): *Linear Patterns of Intergenerational Mobility in Germany and the United States*chap. 8. Cambridge University Press.

Dardanononi, V., G. Fields, J. Roemer, and M. L. S. Puerta (2006): *How Demanding Should Equality of Opportunity Be, and How Much Have We Achieved?*chap. 3. Stanford University Press, in Mobility and Inequality:Frontiers of Research in Sociology and Economics.

Dearden, L., S. Machin, and H. Reed (1997): "Intergenerational Mobility in Britain," *Economic Journal*, 107, 47–66.

Dworkin, R. (1981a): "What is Equality? Part 1: Equality of Welfare," *Philosophy and Public Affairs*, 10(3), 185–246.

——— (1981b): "What is Equality? Part 2: Equality of Resources," *Philosophy and Public Affairs*, 10(4), 283–345.

——— (2000): *Sovereign Virtue: The Theory and Practice of Equality*. Harvard University Press.

Dynarski, S. (2007): "Cradle to College: The Puzzle of Gender Differences in Educational Outcomes," Mimeo Harvard University Kennedy School of Government.

Erikson, R., and J. H. Goldthorpe (1992): *The Constant Flux: A Study of Class Mobility in Industrial Societies*. Oxford University Press.

Friedman, M. (2005): *The Moral Consequences of Economic Growth*. Alfred Knopf New York.

GILLHAM, N. W. (2001): *A Life of Sir Francis Galton: From African Exploration to the Birth of Eugenics*. Oxford University Press.

GOLDIN, C., AND L. KATZ (2002): "The Power of the Pill: Oral contraceptives and Women's Career and Marriage Decisions," *Journal of Political Economy*, 110, 730–770.

GOLDIN, C., L. KATZ, AND I. KUZIEMKO (2006): "The Homecoming of American College Women: The Reversal of the College Gender Gap," *Journal of Economic Perspectives*.

GRAWE, N. (2004): "Reconsidering the Use of Nonlinearities in Generational Earnings Mobility as a Test for Credit Constraints," *Journal of Human Resources*, 39, 813–827.

HART, P. (1983): "The Size Mobility of Earnings," *Oxford Bulletin Of Economics and Statistics*, 45, 181–193.

JACOB, B. (2002): "Where the boys aren't: Non-Cognitive Skills, Returns to School and the Gender Gap in Higher Education," *Economics of Education Review*, 21, 589–598.

JENCKS, C., AND L. TACH (2006): *Would Equal Opportunity Mean More Mobility?*Stanford University Press, in Mobility and Inequality: Frontiers of Research in Sociology and Economics, edited by Stephen Morgan and David Grusky and Gary Fields.

KANBUR, R., AND J. STIGLITZ (1986): "Intergenerational Mobility and Dynastic Inequality.," Woodrow Wilson Discussion Paper No 111 Princeton University.

MAASOUMI, E. (1986): "The Measurement and Decomposition of Earnings Mobility," *Econometrica*, 54, 991–997.

——— (1996): *On Mobility*Marcel Dekker, in Handbook of Applied Economic Statistics edited by D. Giles and A. Ullah.

MULLIGAN, C. B. (1999): "Galton versus the Human Capital Approach," *Journal of Political Economy*, 107, 184–224.

NUSSBAUM, M. (2006): *Poverty and Human Functioning: Capabilities as Fundamental Freedoms*in Poverty and Inequality edited by David Grusky and Ravi Kanbur.

PEZZINI, S. (2002): "The Effect of Women's Rights on Womens Welfare: The Results of a Natural Experiment," *Economic Journal*, pp. 208–227.

Piketty, T. (2000): *Theories of Persistent Inequality and Intergenerational Mobility*vol. 1 of *Handbook of Income Distribution*, chap. 8. North Holland.

Sen, A. (1990): *Gender and Cooperative Conflicts.*pp. 123–149. Oxford University Press.

——— (1995): *Gender Inequality and Theories of Justice.*Clarendon Oxford, in Women, Culture and Development edited by Martha Nussbaum and Jonathan Glover.

Shorrocks, A. (1978): "The Measurement of Mobility," *Econometrica*, 46, 1013–1024.

Sig, P. (1955): "Measuring Social Mobility," *Journal of the Royal Statistical Society Series A*, pp. 56–66.

Siow, A. (2002): "Do Innovations in Birth Control Technology Improve the Welfare of Women," Mimeo University of Toronto.

Solon, G. (1992): "Intergenerational Income Mobility in the United States," *American Economic Review*, pp. 393–408.

Table 1: Attainment Definition by Year

| Index/Year | 2005 |
| --- | --- |
| 1 | Some Secondary or Elementary or No Education |
| 2 | High School Diploma |
| 3 | Some University |
| 4 | Trade or Technical Diploma or Certificate |
| 5 | Bachelors or Masters or Doctorate Degree |

Table 2: Summary Statisitcs by Gender and Cohort

| Dec | Gdr | Obs. | Edu. Var. | Dropout | High Sch | Some Uni. | Tech Educ | Uni. |
|---|---|---|---|---|---|---|---|---|
| 70s | Male | 1124 | Own | 0.08452 | 0.16459 | 0.16726 | 0.32473 | 0.2589 |
| | | | Father's | 0.14947 | 0.23843 | 0.1726 | 0.26068 | 0.34698 |
| | | | Mother's | 0.051601 | 0.10053 | 0.11477 | 0.1895 | 0.16459 |
| | Fem. | 1467 | Own | 0.072256 | 0.12883 | 0.14724 | 0.33129 | 0.32038 |
| | | | Father's | 0.11452 | 0.26517 | 0.25153 | 0.22836 | 0.31016 |
| | | | Mother's | 0.063395 | 0.12338 | 0.14519 | 0.15678 | 0.1152 |
| 60s | Male | 1378 | Own | 0.127 | 0.16328 | 0.1357 | 0.33382 | 0.2402 |
| | | | Father's | 0.19739 | 0.36212 | 0.31277 | 0.2373 | 0.29536 |
| | | | Mother's | 0.026125 | 0.057329 | 0.06894 | 0.12554 | 0.099419 |
| | Fem. | 1740 | Own | 0.079885 | 0.16322 | 0.15632 | 0.33851 | 0.26207 |
| | | | Father's | 0.16149 | 0.38736 | 0.37184 | 0.19943 | 0.25057 |
| | | | Mother's | 0.042529 | 0.067816 | 0.087931 | 0.11207 | 0.085632 |
| 50s | Male | 1392 | Own | 0.15589 | 0.19612 | 0.14943 | 0.26796 | 0.2306 |
| | | | Father's | 0.24282 | 0.47414 | 0.37931 | 0.14727 | 0.25431 |
| | | | Mother's | 0.022989 | 0.04023 | 0.042385 | 0.086925 | 0.05819 |
| | Fem. | 1653 | Own | 0.13067 | 0.20387 | 0.13067 | 0.32002 | 0.21476 |
| | | | Father's | 0.19964 | 0.45312 | 0.44223 | 0.16999 | 0.21355 |
| | | | Mother's | 0.027223 | 0.036903 | 0.065336 | 0.07925 | 0.052027 |
| 40s | Male | 1072 | Own | 0.2528 | 0.16418 | 0.11567 | 0.23507 | 0.23228 |
| | | | Father's | 0.33862 | 0.45802 | 0.38899 | 0.14646 | 0.17724 |
| | | | Mother's | 0.015858 | 0.01959 | 0.034515 | 0.054104 | 0.044776 |
| | Fem. | 1335 | Own Edu | 0.22996 | 0.19625 | 0.1161 | 0.2794 | 0.17828 |
| | | | Father's | 0.24494 | 0.47116 | 0.49738 | 0.11985 | 0.14457 |
| | | | Mother's | 0.020225 | 0.030712 | 0.048689 | 0.053184 | 0.044195 |
| $\leq$ 30s | Male | 1112 | Own | 0.44424 | 0.13579 | 0.10522 | 0.15198 | 0.16277 |
| | | | Father's | 0.45054 | 0.42536 | 0.3732 | 0.088129 | 0.10252 |
| | | | Mother's | 0.016187 | 0.015288 | 0.027878 | 0.033273 | 0.029676 |
| | Fem. | 1760 | Own | 0.44261 | 0.17557 | 0.10625 | 0.18011 | 0.095455 |
| | | | Father's | 0.40852 | 0.40114 | 0.4233 | 0.076705 | 0.089773 |
| | | | Mother's | 0.013068 | 0.023864 | 0.032386 | 0.039205 | 0.032955 |

Table 3: Males vs. Females Cumulative Densities and First Order Dominance Results

| Dec | Gdr | Var | Dropout | High Sch | Some Uni. | Tech Educ | Uni. |
|---|---|---|---|---|---|---|---|
| | Male | CDF | 0.08452 | 0.24911 | 0.41637 | 0.74110 | 1.00000 |
| | Fem. | CDF | 0.07226 | 0.20109 | 0.34833 | 0.67962 | 1.00000 |
| 70s | | diff | 0.01226 | 0.04802 | 0.06804 | 0.06148 | |
| | | Std Err | 0.01070 | 0.01661 | 0.019260 | 0.01786 | |
| | | P(Z≤z) | 0.87409 | 0.99808 | 0.99979 | 0.99971 | |
| | Male | CDF | 0.12700 | 0.29028 | 0.42598 | 0.75980 | 1.00000 |
| | Fem. | CDF | 0.07988 | 0.24310 | 0.39942 | 0.73793 | 1.00000 |
| 60s | | diff | 0.04711 | 0.04717 | 0.02655 | 0.02186 | |
| | | Std Err | 0.01108 | 0.01598 | 0.01776 | 0.01561 | |
| | | P(Z≤z) | 0.99999 | 0.99843 | 0.93260 | 0.91939 | |
| | Male | CDF | 0.15589 | 0.35201 | 0.50144 | 0.76940 | 1.00000 |
| | Fem. | CDF | 0.13067 | 0.33454 | 0.46521 | 0.78523 | 1.00000 |
| 50s | | diff | 0.02522 | 0.01747 | 0.03623 | -0.01583 | |
| | | Std Err | 0.01278 | 0.01728 | 0.01817 | 0.01515 | |
| | | P(Z≤z) | 0.97580 | 0.84401 | 0.97693 | 0.14802 | |
| | Male | CDF | 0.25280 | 0.41698 | 0.53265 | 0.76772 | 1.00000 |
| | Fem. | CDF | 0.22996 | 0.42621 | 0.54231 | 0.82171 | 1.00000 |
| 40s | | diff | 0.02284 | -0.00923 | -0.00966 | -0.05399 | |
| | | Std Err | 0.01757 | 0.02025 | 0.02045 | 0.01662 | |
| | | P(Z≤z) | 0.90314 | 0.32425 | 0.31832 | 0.00058 | |
| | Male | CDF | 0.44424 | 0.58003 | 0.68525 | 0.83723 | 1.00000 |
| | Fem. | CDF | 0.44261 | 0.61818 | 0.72443 | 0.90454 | 1.00000 |
| ≤ 30s | | diff | 0.00163 | -0.03815 | -0.03918 | -0.06731 | |
| | | Std Err | 0.01903 | 0.01879 | 0.01753 | 0.01310 | |
| | | P(Z≤z) | 0.53413 | 0.02118 | 0.01272 | 0.00000 | |

Table 4: OLS and an Examination of Heteroskedasticty by Cohort

| | Male | | Female | |
|---|---|---|---|---|
| | Father | Mother | Father | Mother |
| | Cohort Aged 25-34 | | | |
| $R^2$ | 0.1446 | 0.109 | 0.1382 | 0.1338 |
| $\overline{R}^2$ | 0.1361 | 0.1002 | 0.1317 | 0.1273 |
| $\sigma^2$ | 1.3869 | 1.4446 | 1.3402 | 1.347 |
| No. of Observations | 1124 | 1124 | 1467 | 1467 |
| Intercept | 2.995043 | 3.017275 | 3.084971 | 3.032327 |
| | (29.020461) | (27.841884) | (36.305461) | (32.052569) |
| Parent's Educ. | 0.294096 | 0.346967 | 0.490942 | 0.486381 |
| | (3.740535) | (4.38566) | (7.301364) | (6.722838) |
| Parent's Educ.$^2$ | -0.005684 | -0.021736 | -0.047903 | -0.042121 |
| | (-0.393206) | (-1.498282) | (-3.785692) | (-3.119218) |
| | Heteroskedasticity | | | |
| Parent's Educ. | -0.150491 | -0.190742 | -0.139681 | -0.148026 |
| | (-3.956094) | (-4.921572) | (-4.804017) | (-4.347024) |
| | Cohort Aged 35-44 | | | |
| $R^2$ | 0.1479 | 0.1407 | 0.1114 | 0.102 |
| $\overline{R}^2$ | 0.141 | 0.1338 | 0.1057 | 0.0963 |
| $\sigma^2$ | 1.5544 | 1.5676 | 1.4123 | 1.4271 |
| No. of Observations | 1378 | 1378 | 1740 | 1740 |
| Intercept | 2.855053 | 2.827214 | 3.017797 | 2.944369 |
| | (30.555013) | (30.513651) | (38.494648) | (35.431259) |
| Parent's Educ. | 0.514305 | 0.58474 | 0.427259 | 0.502172 |
| | (6.801012) | (7.976004) | (6.602561) | (7.524187) |
| Parent's Educ.$^2$ | -0.041497 | -0.057707 | -0.033671 | -0.049982 |
| | (-2.896396) | (-4.049962) | (-2.70557) | (-3.844763) |
| | Heteroskedasticity | | | |
| Parent's Educ. | -0.240949 | -0.256225 | -0.165621 | -0.266297 |
| | (-8.658296) | (-8.259951) | (-5.697331) | (-7.567021) |

$t$-statistics are in parentheses.

Nine Provincial Indicators were included in each main regression.

Table 5: OLS and an Examination of Heteroskedasticty by Cohort, Cont'd

| | Male | | Female | |
|---|---|---|---|---|
| | Father | Mother | Father | Mother |
| | Cohort Aged 45-54 | | | |
| $R^2$ | 0.0959 | 0.1097 | 0.1263 | 0.1537 |
| $\overline{R}^2$ | 0.0887 | 0.1026 | 0.1204 | 0.1481 |
| $\sigma^2$ | 1.7885 | 1.7611 | 1.606 | 1.5556 |
| No. of Observations | 1392 | 1392 | 1653 | 1653 |
| Intercept | 2.721268 | 2.653812 | 2.776854 | 2.56765 |
| | (27.741122) | (27.991677) | (31.927768) | (29.094962) |
| Parent's Educ. | 0.526607 | 0.640861 | 0.542602 | 0.788094 |
| | (6.301199) | (8.350317) | (7.625573) | (10.956708) |
| Parent's Educ.$^2$ | -0.050529 | -0.071982 | -0.049095 | -0.095295 |
| | (-3.084545) | (-4.512086) | (-3.476706) | (-6.450287) |
| | Heteroskedasticity | | | |
| Parent's Educ. | -0.176357 | -0.204487 | -0.234572 | -0.361265 |
| | (-4.501748) | (-5.871746) | (-8.753476) | (-11.059479) |
| | Cohort Aged 55-64 | | | |
| $R^2$ | 0.1676 | 0.1324 | 0.1491 | 0.1539 |
| $\overline{R}^2$ | 0.1589 | 0.1234 | 0.142 | 0.1469 |
| $\sigma^2$ | 1.9688 | 2.0519 | 1.8101 | 1.7999 |
| No. of Observations | 1072 | 1072 | 1335 | 1335 |
| Intercept | 2.384708 | 2.544467 | 2.433362 | 2.333294 |
| | (20.724079) | (22.015487) | (26.029788) | (23.780432) |
| Parent's Educ. | 1.01177 | 0.833904 | 0.810428 | 0.863006 |
| | (10.562319) | (8.818408) | (9.782761) | (10.032264) |
| Parent's Educ.$^2$ | -0.136001 | -0.112487 | -0.095353 | -0.103723 |
| | (-6.792304) | (-5.473845) | (-5.471985) | (-5.714139) |
| | Heteroskedasticity | | | |
| Parent's Educ. | -0.037625 | -0.10677 | -0.169192 | -0.203614 |
| | (-0.818305) | (-2.685111) | (-4.148886) | (-4.805476) |

*t*-statistics are in parentheses.

Nine Provincial Indicators were included in each main regression.

Table 6: OLS and an Examination of Heteroskedasticty by Cohort, Cont'd

| | Male | | Female | |
|---|---|---|---|---|
| | Father | Mother | Father | Mother |
| | Cohort Aged $\geq$ 65 | | | |
| $R^2$ | 0.1342 | 0.1096 | 0.1081 | 0.0964 |
| $\overline{R}^2$ | 0.1255 | 0.1007 | 0.1025 | 0.0907 |
| $\sigma^2$ | 2.1154 | 2.1755 | 1.8248 | 1.8489 |
| No. of Observations | 1112 | 1112 | 1760 | 1760 |
| Intercept | 2.031831 | 2.108669 | 2.043832 | 2.055929 |
| | (19.772155) | (20.54748) | (26.59078) | (26.323271) |
| Parent's Educ. | 0.673256 | 0.718184 | 0.538557 | 0.512703 |
| | (6.950697) | (7.313084) | (7.46095) | (7.024051) |
| Parent's Educ.$^2$ | -0.049102 | -0.081476 | -0.046814 | -0.045753 |
| | (-2.227337) | (-3.57516) | (-2.919643) | (-2.777415) |
| | Heteroskedasticity | | | |
| Parent's Educ. | 0.097932 | 0.167642 | 0.111202 | 0.132869 |
| | (2.050648) | (3.639838) | (3.417443) | (3.823226) |

*t*-statistics are in parentheses.

Nine Provincial Indicators were included in each main regression.

Table 7: Standard Normal Tests for concavity changes across Cohort

| | Male | | Female | |
|---|---|---|---|---|
| | Father | Mother | Father | Mother |
| c1-c2 | -1.7596274 | -1.7689706 | 0.80188777 | -0.41937974 |
| | (0.039235502) | (0.038449392) | (0.78869106) | (0.33746931) |
| c1-c3 | -2.0526429 | -2.3301918 | -0.062865646 | -2.6566616 |
| | (0.02005361) | (0.0098980082) | (0.47493675) | (0.0039459314) |
| c2-c3 | -0.41502219 | -0.66736894 | -0.81944556 | -2.3026023 |
| | (0.33906283) | (0.25226825) | (0.20626613) | (0.010650615) |
| c1-c4 | -5.2769213 | -3.6077128 | -2.2033571 | -2.7228621 |
| | (6.5686130e-008) | (0.00015445410) | (0.013784794) | (0.0032359530) |
| c2-c4 | -3.8383955 | -2.1906283 | -2.8805329 | -2.4069951 |
| | (6.1920459e-005) | (0.014239350) | (0.0019850173) | (0.0080421939) |
| c3-c4 | -3.3038931 | -1.5569616 | -2.0624190 | -0.36010558 |
| | (0.00047676085) | (0.059739800) | (0.019583929) | (0.35938409) |
| c1-c5 | -1.6469963 | -2.2113475 | 0.053315131 | -0.17051128 |
| | (0.049779405) | (0.013505892) | (0.52125959) | (0.43230403) |
| c2-c5 | -0.28925440 | -0.88435328 | -0.64752978 | 0.20152543 |
| | (0.38619335) | (0.18825277) | (0.25864456) | (0.57985613) |
| c3-c5 | 0.051956645 | -0.34128498 | 0.10675907 | 2.2389218 |
| | (0.52071838) | (0.36644453) | (0.54250994) | (0.98741950) |
| c4-c5 | 2.9179442 | 1.0105761 | 2.0497787 | 2.3649169 |
| | (0.99823826) | (0.84389033) | (0.97980698) | (0.99098294) |

P values in parenthesis.

Table 8: Standard Normal Tests for Heteroskedasticity Changes Aross Cohort

| | Male | | Female | |
|---|---|---|---|---|
| | Father | Mother | Father | Mother |
| c2-c1 | -1.9192158 | -1.3191117 | -0.63090881 | -2.4151939 |
| | (0.027478515) | (0.093565886) | (0.26405007) | (0.0078634174) |
| c3-c1 | -0.47368838 | -0.26379705 | -2.3997927 | -4.5190324 |
| | (0.31786107) | (0.39596815) | (0.0082021803) | (3.1061445e-006) |
| c3-c2 | 1.3441698 | 1.1093609 | -1.7439631 | -1.9778536 |
| | (0.91055326) | (0.86636273) | (0.040582758) | (0.023972612) |
| c4-c1 | 1.8913330 | 1.5122837 | -0.58922818 | -1.0226127 |
| | (0.97071004) | (0.93476915) | (0.27785411) | (0.15324549) |
| c4-c2 | 3.7831263 | 2.9634855 | -0.071304899 | 1.1380397 |
| | (0.99992256) | (0.99847912) | (0.47157755) | (0.87244805) |
| c4-c3 | 2.2966909 | 1.8486678 | 1.3398421 | 2.9466876 |
| | (0.98918180) | (0.96774710) | (0.90985165) | (0.99839401) |
| c5-c1 | 4.0688148 | 5.9537899 | 5.7492579 | 5.7731670 |
| | (0.99997637) | (1.0000000) | (1.0000000) | (1.0000000) |
| c5-c2 | 6.1310152 | 7.6331583 | 6.3442774 | 8.0705651 |
| | (1.0000000) | (1.0000000) | (1.0000000) | (1.0000000) |
| c5-c3 | 4.4405707 | 6.4447040 | 8.2027027 | 10.360267 |
| | (0.99999551) | (1.0000000) | (1.0000000) | (1.0000000) |
| c5-c4 | 2.0448120 | 4.5098122 | 5.3744939 | 6.1401382 |
| | (0.97956330) | (0.99999676) | (0.99999996) | (1.0000000) |

P values are in parenthesis

Table 9: Change in Mobility for each Gender by Cohort

| | Male Child | | | Female Child | | | | |
|---|---|---|---|---|---|---|---|---|
| | Mother | Father | Diff. | Mother | Father | Diff. | Mothers' Diff. | Father's Diff. |
| 25-34 | 0.89299 | 0.85161 | 2.7081 | 0.88664 | 0.87574 | 0.845 | 0.43346 | -1.6465 |
| | (0.0099978) | (0.011558) | [0.0067673] | (0.0087963) | (0.0094367) | [0.39811] | [0.66468] | [0.099651] |
| Sample Size | 956 | 946 | | 1299 | 1222 | | | |
| 35-44 | 0.89918 | 0.85339 | 3.2873 | 0.90593 | 0.87857 | 2.3608 | -0.4606 | -1.7183 |
| | (0.0090534) | (0.010588) | [0.0010117] | (0.0076425) | (0.0087139) | [0.018234] | [0.64509] | [0.085751] |
| Sample Size | 1106 | 1116 | | 1459 | 1405 | | | |
| 45-54 | 0.9089 | 0.89234 | 1.2805 | 0.90008 | 0.89124 | 0.73529 | 0.60189 | 0.074839 |
| | (0.0088634) | (0.0094185) | [0.20037] | (0.0082451) | (0.0087432) | [0.46216] | [0.54725] | [0.94034] |
| Sample Size | 1054 | 1083 | | 1323 | 1268 | | | |
| 55-64 | 0.90596 | 0.87633 | 1.8205 | 0.89132 | 0.88449 | 0.47705 | 0.99861 | -0.55629 |
| | (0.010962) | (0.012029) | [0.06869] | (0.0098029) | (0.010459) | [0.63333] | [0.31798] | [0.57801] |
| Sample Size | 709 | 749 | | 1008 | 934 | | | |
| $\geq$ 65 | 0.87484 | 0.86311 | 0.61831 | 0.87301 | 0.87874 | -0.39108 | 0.12518 | 1.0662 |
| | (0.013387) | (0.013441) | [0.53637] | (0.01032) | (0.010406) | [0.69574] | [0.90038] | [0.28632] |
| Sample Size | 611 | 654 | | 1041 | 984 | | | |

Note: P-Values are in Parentheses.

Note: Standard Errors are in Parenthesis.

Table 10: Change in Overlap for each Gender by Cohort: Females

| Cohort | 25-34 | 35-44 | 45-54 | 55-64 |
|---|---|---|---|---|
| | For Mothers and Females | | | |
| 35-44 | -1.6559 | | | |
| | [0.097742] | | | |
| 45-54 | -1.1146 | 0.52105 | | |
| | [0.26503] | [0.60234] | | |
| 55-64 | -0.35579 | 1.1753 | 0.68324 | |
| | [0.722] | [0.23986] | [0.49446] | |
| $\geq$ 65 | 1.0054 | 2.5642 | 2.0494 | 1.2871 |
| | [0.31469] | [0.01034] | [0.040419] | [0.19807] |
| | For Fathers and Females | | | |
| 35-44 | -0.19574 | | | |
| | [0.84481] | | | |
| 45-54 | -1.0697 | -0.92262 | | |
| | [0.28476] | [0.3562] | | |
| 55-64 | -0.56126 | -0.39746 | 0.47984 | |
| | [0.57462] | [0.69102] | [0.63134] | |
| $\geq$ 65 | -0.19283 | -0.01116 | 0.89083 | 0.3615 |
| | [0.84709] | [0.9911] | [0.37302] | [0.71773] |

Note: P-Values are in Brackets.

Table 11: Change in Overlap for each Gender by Cohort, Males

| Cohort | 25-34 | 35-44 | 45-54 | 55-64 |
|---|---|---|---|---|
| | For Mothers and Males | | | |
| 35-44 | -0.45911 | | | |
| | [0.64615] | | | |
| 45-54 | -1.1905 | -0.7667 | | |
| | [0.23385] | [0.44326] | | |
| 55-64 | -0.87412 | -0.47664 | 0.20838 | |
| | [0.38205] | [0.63362] | [0.83494] | |
| $\geq$ 65 | 1.0864 | 1.5064 | 2.1213 | 1.7986 |
| | [0.2773] | [0.13197] | [0.033895] | [0.072076] |
| | For Fathers and Males | | | |
| 35-44 | -0.11371 | | | |
| | [0.90946] | | | |
| 45-54 | -2.7318 | -2.7484 | | |
| | [0.0062982] | [0.0059884] | | |
| 55-64 | -1.4823 | -1.4318 | 1.0475 | |
| | [0.13826] | [0.1522] | [0.29486] | |
| $\geq$ 65 | -0.64895 | -0.56816 | 1.7808 | 0.73311 |
| | [0.51637] | [0.56993] | [0.074951] | [0.46349] |

Note: P-Values are in Brackets.

Table 12: Qualified Mobility

| | Mother's Attainment | | | | | Father's Attainment | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Female Child | | | | | | | | | |
| | Drop Out | High Sch. | Some Coll. | Tech. Educ. | University | Drop Out | High Sch. | Some Coll. | Tech Educ. | University |
| 25-34 | 0.84368 | 0.98705 | 0.8183 | 0.89333 | 0.73926 | 0.83636 | 0.96801 | 0.87927 | 0.90205 | 0.7859 |
| | (0.018905) | (0.0052999) | (0.039985) | (0.021151) | (0.033772) | (0.018757) | (0.0096138) | (0.034931) | (0.022094) | (0.027048) |
| 35-44 | 0.91119 | 0.97332 | 0.82937 | 0.87029 | 0.76055 | 0.91413 | 0.93799 | 0.82456 | 0.80728 | 0.71275 |
| | (0.011184) | (0.0077178) | (0.04373) | (0.027162) | (0.03496) | (0.010792) | (0.012947) | (0.045138) | (0.036311) | (0.032403) |
| 45-54 | 0.92237 | 0.92714 | 0.67997 | 0.84108 | 0.78876 | 0.92666 | 0.92317 | 0.86151 | 0.86702 | 0.64193 |
| | (0.009897) | (0.013834) | (0.06954) | (0.03518) | (0.044016) | (0.0095253) | (0.015887) | (0.050929) | (0.043476) | (0.041888) |
| 55-64 | 0.91995 | 0.88551 | 0.85615 | 0.76897 | 0.73904 | 0.93104 | 0.85788 | 0.83622 | 0.72831 | 0.64465 |
| | (0.010531) | (0.022919) | (0.067538) | (0.052279) | (0.057174) | (0.010103) | (0.027604) | (0.064422) | (0.069471) | (0.056802) |
| $\geq 65$ | 0.924 | 0.77789 | 0.72823 | 0.71763 | 0.68717 | 0.92186 | 0.76579 | 0.86204 | 0.76786 | 0.7337 |
| | (0.0097087) | (0.033068) | (0.092762) | (0.059624) | (0.06088) | (0.010101) | (0.03645) | (0.060962) | (0.065147) | (0.053214) |
| | Male Child | | | | | | | | | |
| | Drop Out | High Sch. | Some Coll. | Tech Educ. | University | Drop Out | High Sch. | Some Coll. | Tech Educ. | University |
| 25-34 | 0.88197 | 0.94174 | 0.85684 | 0.93663 | 0.78269 | 0.84353 | 0.93886 | 0.87295 | 0.85371 | 0.73472 |
| | (0.023164) | (0.011861) | (0.045988) | (0.02145) | (0.030322) | (0.022192) | (0.013997) | (0.043356) | (0.033245) | (0.03025) |
| 35-44 | 0.90274 | 0.95777 | 0.8914 | 0.83408 | 0.76114 | 0.86753 | 0.92216 | 0.85239 | 0.78821 | 0.7126 |
| | (0.014273) | (0.0099684) | (0.051856) | (0.038167) | (0.036429) | (0.015176) | (0.014816) | (0.057543) | (0.045968) | (0.034407) |
| 45-54 | 0.91679 | 0.96107 | 0.83183 | 0.79327 | 0.74413 | 0.91911 | 0.93997 | 0.88809 | 0.88592 | 0.67001 |
| | (0.01202) | (0.010281) | (0.066117) | (0.052722) | (0.048483) | (0.010614) | (0.01659) | (0.049234) | (0.042483) | (0.042746) |
| 55-64 | 0.92669 | 0.89733 | 0.84701 | 0.82549 | 0.84294 | 0.9116 | 0.83435 | 0.82128 | 0.87539 | 0.71267 |
| | (0.012764) | (0.02202) | (0.087308) | (0.062398) | (0.052518) | (0.012811) | (0.02967) | (0.081682) | (0.072072) | (0.059418) |
| $\geq 65$ | 0.92273 | 0.83193 | 0.70958 | 0.64759 | 0.7245 | 0.91285 | 0.79654 | 0.72946 | 0.61918 | 0.62042 |
| | (0.013108) | (0.035022) | (0.107) | (0.085801) | (0.077772) | (0.012969) | (0.040666) | (0.082493) | (0.11777) | (0.07978) |

Note: Standard Errors are in Parenthesis.

Table 13: Standard Normal Tests of Qualified Mobility Differences Across Cohorts

| | Mother's Attainment (Female Child) | | | | | Father's Attainment (Male Child) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Drop Out | High Sch. | Some Coll. | Tech. Educ. | University | Drop Out | High Sch. | Some Coll. | Tech Educ. | University |
| c2-c1 | 3.07346 | -1.46651 | 0.186821 | -0.66926 | 0.43799 | 0.892696 | -0.81934 | -0.28536 | -1.15459 | -0.48282 |
| | (0.99894) | (0.071254) | (0.574099) | (0.25166) | (0.66930) | (0.81399) | (0.20629) | (0.38768) | (0.12413) | (0.3146) |
| c3-c1 | 3.6876 | -4.0440 | -1.7245 | -1.27288 | 0.89222 | 3.0724 | 0.051138 | 0.23078 | 0.59709 | -1.2357063 |
| | (0.99989) | (0.000026) | (0.042312) | (0.10153) | (0.81386) | (0.99894) | (0.52039) | (0.591262) | (0.72478) | (0.10828) |
| c3-c2 | 0.74861 | -2.9152 | -1.8187 | -0.65721 | 0.50186 | 2.7852 | 0.80071 | 0.47141 | 1.5610 | -0.77615 |
| | (0.77295) | (0.0017774) | (0.034479) | (0.25552) | (0.69212) | (0.99733) | (0.78835) | (0.68132) | (0.94074) | (0.21883) |
| c4-c1 | 3.5244 | -4.3165 | 0.48225 | -2.2051 | -0.0033131 | 2.6565 | -3.1857 | -0.55874 | 0.27315 | -0.33071 |
| | (0.99979) | (0.0000079) | (0.68518) | (0.013722) | (0.49868) | (0.99605) | (0.00072) | (0.28817) | (0.60763) | (0.37043) |
| c4-c2 | 0.57025 | -3.631 | 0.33284 | -1.7198 | -0.32097 | 2.219 | -2.6478 | -0.31136 | 1.0198 | 0.0010195 |
| | (0.71574) | (0.000141) | (0.63037) | (0.042735) | (0.37412) | (0.98676) | (0.0040511) | (0.37776) | (0.84610) | (0.50041) |
| c4-c3 | -0.16745 | -1.5551 | 1.8174 | -1.1444 | -0.68908 | -0.45141 | -3.1071 | -0.70052 | -0.12586 | 0.58282 |
| | (0.43351) | (0.059965) | (0.96542) | (0.12624) | (0.24539) | (0.32585) | (0.00094469) | (0.24180) | (0.44992) | (0.71999) |
| c5-c1 | 3.7794 | -6.2454 | -0.89167 | -2.7772 | -0.74821 | 2.6969 | -3.3092 | -1.5397 | -1.9165 | -1.3396 |
| | (0.99992) | (0.000000) | (0.18629) | (0.0027412) | (0.22717) | (0.99650) | (0.00047) | (0.061815) | (0.027649) | (0.090184) |
| c5-c2 | 0.86495 | -5.7553 | -0.98622 | -2.33000 | -1.0452 | 2.2702 | -2.9024 | -1.2222 | -1.3370 | -1.0610 |
| | (0.80647) | (0.000000) | (0.16201) | (0.00990) | (0.14796) | (0.98840) | (0.0018514) | (0.11081) | (0.090609) | (0.14435) |
| c5-c3 | 0.11757 | -4.1637 | 0.41627 | -1.7832 | -1.3523 | -0.37354 | -3.2657 | -1.6512 | -2.1305 | -0.54789 |
| | (0.5468) | (0.00002) | (0.66139) | (0.037276) | (0.088143) | (0.35437) | (0.00054593) | (0.049346) | (0.016563) | (0.2919) |
| c5-c4 | 0.28275 | -2.6749 | -1.1148 | -0.64743 | -0.62106 | 0.06857 | -0.75110 | -0.79093 | -1.8556 | -0.92736 |
| | (0.61132) | (0.0037381) | (0.13246) | (0.25868) | (0.26728) | (0.52733) | (0.22629) | (0.21449) | (0.031754) | (0.17687) |

Note: P values in Parenthesis.

Table 14: Standard Normal Tests of Qualified Mobility Differences Across Parental Attainments

| | Mother's Attainment (Female Child) | | | | | Father's Attainment (Male Child) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 25-34 | 35-44 | 45-54 | 55-64 | Over 64 | 25-34 | 35-44 | 45-54 | 55-64 | Over 64 |
| a2-a1 | 7.30220 | 4.57230 | 0.28040 | -1.36540 | -4.23950 | 3.63340 | 2.57580 | 1.05920 | -2.39030 | -2.72490 |
| | (1.00000) | (1.00000) | (0.61040) | (0.08610) | (0.00000) | (0.99990) | (0.99500) | (0.85520) | (0.00840) | (0.00320) |
| a3-a1 | -0.57380 | -1.81270 | -3.45100 | -0.93340 | -2.09900 | 0.60400 | -0.25440 | -0.61590 | -1.09240 | -2.19610 |
| | (0.28300) | (0.03490) | (0.00030) | (0.17530) | (0.01790) | (0.72710) | (0.39960) | (0.26900) | (0.13730) | (0.01400) |
| a3-a2 | -4.18370 | -3.24170 | -3.48600 | -0.41170 | -0.50430 | -1.44670 | -1.17420 | -0.99860 | -0.15040 | -0.72940 |
| | (0.00000) | (0.00060) | (0.00020) | (0.34030) | (0.30700) | (0.07400) | (0.12020) | (0.15900) | (0.44020) | (0.23290) |
| a4-a1 | 1.75020 | -1.39240 | -2.22430 | -2.83110 | -3.41620 | 0.25470 | -1.63860 | -0.75800 | -0.49470 | -2.47860 |
| | (0.96000) | (0.08190) | (0.01310) | (0.00230) | (0.00030) | (0.60050) | (0.05070) | (0.22420) | (0.31040) | (0.00660) |
| a4-a2 | -4.29810 | -3.64870 | -2.27660 | -2.04160 | -0.88380 | -2.36060 | -2.77350 | -1.18510 | 0.52660 | -1.42350 |
| | (0.00000) | (0.00010) | (0.01140) | (0.02060) | (0.18840) | (0.00910) | (0.00280) | (0.11800) | (0.70070) | (0.07730) |
| a4-a3 | 1.65870 | 0.79490 | 2.06730 | -1.02080 | -0.09610 | -0.35220 | -0.87140 | -0.03340 | 0.49670 | -0.76700 |
| | (0.95140) | (0.78670) | (0.98060) | (0.15370) | (0.46170) | (0.36240) | (0.19180) | (0.48670) | (0.69030) | (0.22160) |
| a5-a1 | -2.69800 | -4.10400 | -2.96150 | -3.11190 | -3.84160 | -2.90030 | -4.11990 | -5.65570 | -3.27280 | -3.61800 |
| | (0.00350) | (0.00000) | (0.00150) | (0.00090) | (0.00010) | (0.00190) | (0.00000) | (0.00000) | (0.00050) | (0.00010) |
| a5-a2 | -7.24840 | -5.94300 | -2.99920 | -2.37790 | -1.30940 | -6.12460 | -5.59400 | -5.88760 | -1.83210 | -1.96680 |
| | (0.00000) | (0.00000) | (0.00140) | (0.00870) | (0.09520) | (0.00000) | (0.00000) | (0.00000) | (0.03350) | (0.02460) |
| a5-a3 | -1.51020 | -1.22920 | 1.32190 | -1.32340 | -0.37010 | -2.61470 | -2.08500 | -3.34470 | -1.07530 | -0.95020 |
| | (0.06550) | (0.10950) | (0.90690) | (0.09280) | (0.35570) | (0.00450) | (0.01850) | (0.00040) | (0.14110) | (0.17100) |
| a5-a4 | -3.86640 | -2.47880 | -0.92850 | -0.38630 | -0.35750 | -2.64730 | -1.31680 | -3.58260 | -1.74210 | 0.00870 |
| | (0.00010) | (0.00660) | (0.17660) | (0.34960) | (0.36040) | (0.00410) | (0.09390) | (0.00020) | (0.04070) | (0.50350) |

Note: P values in Parenthesis.

Table 15: Mobility Differences Daughters of Mothers - Sons of Fathers

| | Parental Attainment | | | | |
|---|---|---|---|---|---|
| | Drop Out | High Sch. | Some Coll. | Tech Educ. | University |
| 25-34 | 0.0051453090 | 3.2197942 | -0.92659826 | 1.0055077 | 0.10013489 |
| | (0.50205267) | (0.99935859) | (0.17706758) | (0.84267378) | (0.53988138) |
| 35-44 | 2.3159512 | 3.0624394 | -0.31851076 | 1.5372751 | 0.97754531 |
| | (0.98971953) | (0.99890230) | (0.37504877) | (0.93788702) | (0.83585037) |
| 45-54 | 0.22463663 | -0.59395115 | -2.4425954 | -0.81293301 | 1.9354080 |
| | (0.58886902) | (0.27627239) | (0.0072910371) | (0.20812823) | (0.97352988) |
| 55-64 | 0.50350227 | 1.3645872 | 0.32900135 | -1.1952425 | 0.31979815 |
| | (0.69269441) | (0.91380858) | (0.62892267) | (0.11599615) | (0.62543933) |
| over 65 | 0.68825349 | -0.35582169 | -0.0099084434 | 0.74581633 | 0.66513556 |
| | (0.75435342) | (0.36098705) | (0.49604717) | (0.77211081) | (0.74701810) |

Note: P values are in parenthesis