Marital Sorting and Intergenerational Mobility in South Africa

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Abstract

The paper estimates the effect of family background on individual earnings in a framework that highlights the role played by assortative mating. The empirical analysis is motivated by a simple model of intergenerational transmission of economic status that takes into account nonrandomenss in the process of spouse selection. The model shows that offspring earnings are associated to the human capital of both parents and parents-in-law. Using data from the National Income Dynamics Study (NIDS), the paper measures the role of assortative mating and intergenerational economic persistence in explaining the variation in male earnings in South Africa.

Keywords: Intergenerational Mobility, Marital Sorting

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1. Introduction

The earlier economic literature on intergenerational mobility focused on the measurement of income persistence across generations (see Solon, 1999, for a review). Over the last decade, increased availability of longitudinal data and advances in econometric techniques have allowed economists to overcome some of the most common measurement issues and to obtain reliable estimates of intergenerational income mobility in a number of countries (Corak, 2006; Bjorklund and Jantti, 2009). Though this research is highly descriptive, it has also stimulated the investigation on the "transmission channels" in the reproduction of inequality (see Black and Devereux, 2010, for a review of the most recent contributions). Of the several plausible mechanisms that could account for the finding of significant intergenerational association in incomes, credit market imperfections, human capital acquisition, and neighbourhood effects have received greater attention (Becker and Tomes, 1979, 1986; Mulligan 1999; Oreopolous, 2003; Grawe, 2004). A number of recent papers have also analyzed the link between marital sorting – who marries whom – and the intergenerational transmission of economic status. Intuitively, if parental socio-economic background is a dimension along which people sort into marriage, the degree of economic mobility across generations will be affected.[1]

Two seminal papers by Lam and Schoeni (1993, 1994) provide a model that links the degree of assortative mating[2] to intergenerational inequality. In the first paper, the authors find that the wages of Brazilian workers are more highly correlated to parents-in-law's schooling than to own parent's schooling. This result is interpreted as evidence that parental background serves as proxy for unobserved worker characteristics rather than as indicator of nepotism in the labour

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[1] Evidence on marital sorting by parental traits is provided in a recent study by Charles, Hurst and Killewald (2011). The study shows that men and women in the United States tend to find spouses from similar parental wealth backgrounds, especially in the tails of the distribution.

[2] In the remainder of the paper, the term "assortative mating" will denote the tendency of individuals to choose spouses with similar earnings potential.

market. The second paper compares the results from a series of wage equations in the United States and Brazil. On the basis of their model of intergenerational links, differences in the apparent effect of fathers and fathers-in law across countries can be attributed to variation in the degrees of assortative mating, female labour market participation, and family nepotism. Chadwick and Solon (2002) use data on married couples in the United States and find that the elasticity of individuals' earnings with respect to their own parents' income is the same as the elasticity to the incomes of their parents-in-law. Using data from Germany and the United Kingdom, Ermisch, Francesconi and Siedler (2006) show that marital sorting explains a high proportion of the covariance between offspring's and parents' family income in both countries. Raaum et al. (2007) focus on the contribution of gender and marital status to intergenerational mobility in the United States, the United Kingdom, Denmark, Finland and Norway. They show that the intergenerational earnings mobility of married women is influenced by a combination of assortative mating and labour supply responses.

This paper contributes to the existing literature by providing evidence on South Africa. Countries vary significantly with respect to their labour market institutions, educational systems, degrees of assortative mating, and levels of cross-sectional inequality. Accumulating international evidence can provide valuable insights on the mechanisms underlying intergenerational mobility. In this perspective, South Africa certainly represents an interesting case to add to the literature. The forced racial segregation of the past has a legacy in the highly segmented society of the present. Income inequality is among the highest in the world, and vast differences remain across racial groups in a variety of socioeconomic outcomes (Leibbrandt et al., 2010). Inter-racial marriages are still uncommon (Amoateng, 2004) and labour market

participation among women is still relatively low by international standards (Leibbrandt et al., 2010).

The rest of the paper is structured as follows. The next section offers a theoretical discussion of the links between marital sorting and intergenerational mobility. Section 3 describes the data used for the empirical analysis. The results are presented and discussed in Section 4. Section 5 concludes.

2. Theoretical framework

This section formalizes the role played by assortative mating in the intergenerational transmission of economic status building on the seminal model developed by Lam and Schoeni (1993, 1994). The analytical focus is on the intergenerational determinants of earnings when family background variables also include the characteristics of relatives by marriage. The income generating function for individuals in a given population can be expressed as:

$$Y_i = \beta_0 + \beta_s S_i + \beta_A A_i + u_i \tag{1}$$

where Y_i denotes lifetime income of individual i, S_i is the years of schooling, and A_i indicates unobservable ability.[3] The analogous equation for the income of an individual's partner/spouse is given by:

$$Y_i^p = \beta_0^p + \beta_s^p S_i^p + \beta_A^p A_i^p + u_i^p \tag{2}$$

where p indicates the partner/spouse, and where the parameters need not be equal to those in equation (1).

The empirical analysis in the paper will focus on the determinants of male earnings. Therefore, equations (1) and (2) can be thought of as the earnings equations for husbands and

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[3] The variable A_i is not to be interpreted strictly as innate ability. It refers to any unobservable characteristics affecting income.

wives, respectively. Assume now that schooling and unobserved ability can be decomposed as follows:

$$S_i = \alpha_s + \lambda_s F_i + S_i^u \tag{3}$$

$$A_i = \alpha_a + \lambda_a F_i + A_i^u \tag{4}$$

where each variable has two orthogonal components. The variable F_i denotes father's education and it captures the effect of family background on schooling and ability. This can be interpreted as the "inherited" component of each variable. Consequently, the combined effect of factors that are orthogonal to father's education will represent the "uninherited" component in each equation— S_i^u for schooling and A_i^u for ability.

From equations (1), (3), and (4) we can express husbands' earnings in terms of family background

$$Y_i = \varphi_0 + \varphi_f F_i + U_i \tag{5}$$

where $\varphi_0 = \beta_0 + \beta_s \alpha_s + \beta_a \alpha_a$

$\varphi_f = \beta_s \lambda_s + \beta_a \lambda_a$

$U_i = \beta_s S_i^u + \beta_a A_i^u + u_i$

Under the assumptions of the model, the coefficient on father's schooling in equation (5), φ_f, has a straightforward interpretation: family background affects individuals' earnings indirectly through the inherited component of schooling and ability.

Under the additional assumption that schooling and unobserved ability are correlated only because of the common family background component, i.e. $Corr\,(S_i^u, A_i^u) = 0$, the coefficient on father's schooling when the individual's *own* schooling is included in the

regression will be $\varphi_{f|s_i} = \beta_a \lambda_a$. That is, the coefficient on father's education will only pick up the effect of parental background operating through the inherited component of unobserved ability.

Similarly, the wife's income can be expressed as

$$Y_i^p = \varphi_o^p + \varphi_f^p F_i^p + U_i^p \tag{6}$$

where the effect of family background on earnings, φ_f^p, has the same interpretation as the analogous coefficient in the husbands' equation.

Positive correlations between spouses with respect to characteristics such as age, religion, cognitive test scores, personality traits, education and earnings have been documented in a number of studies (Epstein and Guttman 1984; Kremer 1997; Fernández, Guner and Knowles 2005). In what follows, marital sorting will described by the correlation in spouse's potential earnings. That is, individuals with similar earnings potential are assumed to be more likely to marry each other. Several theoretical explanations have been offered to explain this type of marital sorting (Becker 1991, Lam 1988), but the underlying behavioural process leading to a positive correlation in spouses' earnings is not central for the purposes of our analysis.

If marital sorting occurs, there will be a positive correlation in spouses' earnings, which we express as

$$\gamma = Corr(Y_i, Y_i^p)$$

In other words, γ represents the degree of assortative mating in our population. We assume husbands are indifferent about the determinants of their wives' earnings. That is, the sorting occurs on earnings potential alone, whether those earnings are derived from higher education or mere market luck does not matter. This amounts to assuming zero partial correlations between individuals' earnings and their wives' family background, when wife's earnings are controlled for.

In the presence of marital sorting, regressing the husband's earnings on the wife's earnings will yield a positive coefficient:

$$Y_i = a + b Y_i^p + e \qquad (7)$$

where $b > 0$. The occurrence of marital sorting will therefore create a statistical link between the earnings of an individual and the schooling of his father-in-law. To see this, substitute (6) into (5) and obtain

$$Y_i = \alpha + b \varphi_f^p F_i^p + \varepsilon \qquad (8)$$

where $\alpha = a + b \varphi_0^p$ and $\varepsilon = b U_i^p + e$. Denoting the coefficient on father-in-law schooling with θ, we have that

$$\theta_{f_i^p} = \varphi_f^p \gamma \frac{sd(Y_i)}{sd(Y_i^p)} \qquad (9)$$

where we used the relationship between regression and correlation coefficients. This latter expression clarifies that the observed effect of father-in-law's schooling on husband's earnings will depend on the degree of assortative mating, γ, on the intergenerational coefficient from the wives' regression, φ_f^p, and on the relative dispersion of the husbands and wives earnings distributions.

It is illustrative to characterise how the coefficient on father-in-law's schooling change when the husband's own schooling is controlled for. This can be expressed as

$$\theta_{f_i^p | s_i} = \varphi_f^p \gamma \frac{sd(Y_i)}{sd(Y_i^p)} \left[\frac{1 - \rho_{y_i s_i}^2}{1 - \rho_{y_i s_i}^2 \rho_{y_i y_i^p}^2 R_{y_i^p f_i^p}^2} \right] \qquad (10)$$

Equation (10) clarifies that the extent to which the coefficient on father-in-law's schooling will fall when controlling for own schooling depends on the correlations among the relevant variables. In particular, the coefficient on father-in-law's schooling will fall less when (i) the

correlation between earnings and own schooling, $\rho^2_{y_i s_i}$, is low;   (ii)   assortative mating, $\rho^2_{y^p_i y^p_i}$, is high, and (iii) wife's income has a high inherited component (i.e. $R^2_{y^p_i f^p_i}$ is high).

Before turning to the empirical application, two considerations are in order. First, the interpretation of the coefficients on the basis of the model does not require that we observe the spouse's realized income. Marital sorting with respect to earnings potential is enough for the interpretation to be valid. This is a non-trivial point since the correlation in actual earnings could be smaller than the correlation in earnings potential if there is a negative spouse correlation in hours worked. Second, it is worth clarifying that the empirical analysis in this paper does not estimate the structural parameters of a model of the intergenerational determinants of earnings. The empirical specification below is very straightforward and yields results that are amenable to alternative interpretations. The model outlined in this section, however, provides a useful theoretical framework to interpret the findings on the basis of a fairly basic set of assumptions.

3. Data

The empirical analysis is based upon the National Income Dynamics Study (NIDS), the first national longitudinal study in South Africa. The first wave of NIDS was collected in 2008 and consisted of a nationally representative sample of approximately 7,300 households. NIDS used a combination of household and individual level questionnaires to obtain information on a wide selection of human capital variables, labour force experiences and demographic characteristics such as education, family relationships and household composition. The present study mainly uses information from the adult questionnaire, which includes the wages and other incomes of

the adults in the household, as well as their level of education and employment status.[4] All adults were asked to complete a section on parental background, where information on the educational qualification, living status and occupation of both parents was collected. Key information regarding non-resident and deceased parents was obtained in the retrospective section, in addition to the information on co-residing parents available in other parts of the questionnaire.

For the purposes of the present paper, the empirical analysis is limited to working age males who are either married or living with their partner.[5] This results in a subsample of 2,004 observations from the NIDS adult data.[6] From this sample of married individuals, we limit our analysis to those couples who have non-missing information on the earnings of the husbands and on parental education. Table 1 shows some descriptive statistics for the final analytical sample.

Table 1. Descriptive Statistics

	Husband	Wife
Mean age	42.92 (10.44)	38.99 (11.06)
Mean years of schooling	9.13 (4.34)	9.32 (4.03)
Percent employed	74.52	40.79
Mean income (ZAR)	7,876 (12,390)	4,366 (7,337)
Mean father's schooling	4.91 (5.34)	5.12 (5.34)
N	953	953

Notes: Author's calculations from NIDS (2008). Means calculated using sample weights. The sample consists of married males 25-64 years of age.

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[4] A person is defined as an adult if they were 15 years old or older at the time of the interview. The overall response rate for the adult questionnaire is 92.62%.

[5] In the remainder of the paper, the term 'married' will be used to indicate both legal marriage and domestic partnership.

[6] While there were a total 2,123 observations in the adult data who indicated married/domestic partnership as their marital status, information on their spouse/partner is missing for some of them.

Table 1 shows that husbands in our sample are on average a few years older than wives but have similar education levels. Married men are not only more likely to be employed compared to married women, but their wages are also higher relative to employed wives. Finally, father's schooling is slightly higher for wives than for husbands. However, the difference is not statistically significant and it is probably due to the wives' fathers being younger, on average, than the fathers' of the husbands.[7]

Perhaps surprisingly, there is very little evidence on the extent to which individuals with similar traits tend to marry in South Africa. Up until the 1980s, interracial marriages were not allowed. High levels of segmentation along racial lines remain in today's society. To the extent that income and race are still highly correlated, the low incidence of interracial marriages would contribute to a higher degree of assortative mating in the country. Based on our data, the correlation in spouses' education in South Africa is estimated at 0.71. This value is of similar order of magnitude as the spousal schooling correlation reported for Brazil in Lam and Schoeni (1994).[8] The correlation in spouses' earnings in our South African sample is 0.60. As previously noted, the correlation in earnings will be smaller than the correlation in schooling if there is a negative association between husbands' income and the number of hours worked by the wives.

4. Empirical results

The empirical strategy of the paper is straightforward. We estimate a series of earnings equations where we pay attention to the information provided by the family background variables. We are primarily interested in the magnitude of the coefficients on own father's education, father-in-

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[7] South Africa experienced a large increase in educational attainments after the end of Apartheid, so that younger cohorts are significantly more educated than older cohorts.

[8] In the same paper, Lam and Schoeni estimate the spousal correlation in schooling in the United States to be at 0.57, significantly lower than the one in Brazil.

law's education, and own education. Table 2 presents the results of five specifications of

earnings equations for our sample of married South African men in 2008. All models have log

earnings as the dependent variables and include controls for age, age squared and a race dummy

(i.e. white). In model (1), own father's schooling is included as the explanatory variable.

Unsurprisingly, the coefficient of father's schooling reveals that individuals with higher educated

parents enjoy an earnings advantage. An additional year of father's schooling is associated to a

0.114 increase in log earnings. When comparing this coefficient to that from model (2), we

observe that the magnitude of the coefficient on father-in-law's schooling is higher. The log

earnings advantage associated to a one-year increase in father-in-law schooling is 0.154. Note

also that model (2) has a larger explanatory power as indicated by the value of R^2.

Table 2. Earnings Equations

Variable	Model				
	(1)	(2)	(3)	(4)	(5)
own schooling (years)			.169* (.021)	.144* (.022)	.114* (.024)
own father's schooling (years)	.114* (.018)			.053** (.018)	
father-in-law's schooling (years)		.154* (.045)			.115** (.052)
Age	.013 (.090)	.043 (.074)	.026 (.086)	.028 (.086)	.049 (.073)
Age squared	-.0001 (.001)	-.0004 (.0009)	-.00001 (.001)	-.00008 (.001)	-.0003 (.0008)
White	.375 (.475)	.048 (.703)	.506 (.491)	.177 (.478)	-.1804 (.704)
Intercept	6.86* (1.80)	6.06* (1.42)	5.28* (1.64)	5.23** (1.65)	4.84* (1.42)
R^2	.1987	.2988	.2762	.2901	.3580

Notes: Author's calculations from NIDS (2008). The sample consists of married males 25-64 years of age.

In model (3), we run a standard Mincer regression to estimate the return to own schooling when

no family background variables are included. The estimated coefficient implies average returns

to schooling in South Africa in the order of 17 log points. Incidentally, this value is very close to the estimated returns in Lam and Schoeni (1994) for Brazil.[9] Both countries, therefore, display similarly high average returns to schooling.

When we add father's schooling to the equation in model (4), we observe a decline in the effect of own schooling from 0.169 to 0.144. As expected, the apparent effect of own schooling decreases when a family background variable is added as regressor. When we focus our attention on the magnitude of the coefficient on father's schooling, we see that it is much smaller than the corresponding coefficient in column (1). That is, much of the parental advantage picked up by the father's schooling variable in model (1) seems to 'operate' through higher schooling of the child.

Moving to model (5), we can compare the changes in the estimated coefficients of interest when father-in-law's schooling is included in the equation. Again, the effect of own schooling is mitigated by the inclusion of a family background variable. Interestingly, the fall in the coefficient on own schooling is larger in model (5) as compared to model (4). Also, if we look at the table horizontally and compare the two coefficients on father-in-law's schooling (columns 2 and 5), we see that the drop in the apparent effect of father-in-law's schooling is smaller than the drop we observe in the coefficient on father's schooling in columns 1 and 5.[10]

The results shown in Table 2 can be interpreted in light of the theoretical discussion in Section 2 of this paper. First, earnings equations for South African men show that parental background variables have significant explanatory power. Father-in-law's schooling appears to have a higher effect on earnings compared to the effect of own father's schooling. That husband's earnings may be more highly correlated with their wives family background than with

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[9] The coefficient on own schooling in Brazil is 0.163.

[10] Due to small sample sizes, however, tests for differences in the coefficients across model specifications are not statistically significant.

their own family background was one of the implication of the theoretical model we discussed above. If we think of family background as a signal for unobserved individual characteristics, the model shows that own father's education serves as proxy for just the inherited components of earnings. On the other hand, father-in-law's education signals both the inherited and uninherited determinants of earnings. The model clarifies that the information embedded in the coefficient on father-in-law schooling will be greater in countries, like South Africa, characterised by a degree of assortative mating.

The second main result of in Table 2 is the differential drop in the coefficients on father schooling and father-in-law's schooling when own schooling is included in the earnings equation. The theoretical model presented above allows a revealing interpretation of this finding as well. Controlling for schooling, we expect to see a large decline in the apparent effect of own father's education on earnings when parental advantage operates mostly through the offspring's education. On the other hand, we expect a smaller decline in the apparent effect of father-in-law's education on husband's earnings for high degrees of assortative mating and for high levels of intergenerational transmission of economic status in the wives' population.

Table 3 below reports the coefficients estimated on earnings equations that do not include a control for race. The coefficient on own schooling increases when race is not controlled for. This is a standard result. The coefficient on father's schooling also increases compared to the previous table, but father-in-law's schooling still has a higher effect. Overall, the exclusion of race does not alter the picture obtained from Table 2. The magnitudes of the coefficients as well as the differences across specifications are consistent. Therefore, the theoretical interpretation of the results remains unchanged.

Table 3. Earnings equations, no race control

Variable	Model				
	(1)	(2)	(3)	(4)	(5)
own schooling (years)			.192* (.018)	.146* (.019)	.111** (.033)
own father's schooling (years)	.133* (.025)			.062** (.028)	
father-in-law's schooling (years)		.156* (.018)			.107* (.028)
Age	.009 (.088)	.043 (.072)	.018 (.084)	.062 (.083)	.050 (.071)
Age squared	-.0001 (.001)	-.0004 (.0008)	-.0001 (.0009)	-.00005 (.0009)	-.0003 (.0008)
Intercept	6.89* (1.80)	6.06* (1.42)	5.27* (1.72)	5.23* (1.67)	4.86* (1.48)
R^2	.1935	.2987	.2630	.2889	.3567

Notes: Author's calculations from NIDS (2008). The sample consists of married males 25-64 years of age.

Table 4 replaces the year of schooling variables with education categories. South Africa is characterised by a strong convex relationship between education and earnings (Keswell and Poswell, 2004). Much of the estimated average returns to schooling derive from superior returns at higher education levels. In particular, a spike in the estimated returns to schooling is typically observed for individuals who have at least obtained a high school degree (the matric). The results in Table 4 confirm the convexity of the return structure in South Africa. Most importantly to the purpose of the present analysis, we note that the apparent effects of the schooling of fathers and fathers-in-law are consistent with the results shown in the previous table. Given the convexity in the return structure, however, the patterns we observed for the average schooling effect in the previous tables are now mostly displayed in the coefficients on the higher level education categories. Again, the theoretical interpretation offered for our base results extends to the findings shown in Table 4.

Table 4. Earnings equations, education in levels.

Variable	Model				
	(1)	(2)	(3)	(4)	(5)
own schooling					
1-5 years			.01 (.02)	.03 (.04)	-.01 (.04)
6-8 years			.55** (.18)	.40** (.19)	.30 (.21)
9-11 years			1.06* (.19)	.77* (.19)	.58** (.26)
matric and above			2.04* (.28)	1.53* (.22)	1.01** (.51)
own father's schooling					
1-5 years	.40** (.188)			0.06 (.16)	
6-8 years	1.19* (.20)			0.62* (.17)	
9-11 years	1.50* (.24)			0.82* (.22)	
matric and above	1.57** (.51)			0.62 (.50)	
father-in-law's schooling					
1-5 years		.58** (.23)			.35 (.26)
6-8 years		1.14* (.24)			.81** (.33)
9-11 years		1.75* (,29)			1.30* (.39)
matric and above		2.20* (.24)			1.59** (.51)
Age	.005 (.004)	.033 (.070)	-.026 (.081)	-.011 (.08)	.022 (.06)
Age squared	-.000001 (.001)	-.0003 (.0008)	-.0005 (0009)	-.0004 (.0009)	-.000001 (.0007)
Intercept	7.02* (1.85)	6.27* (1.36)	6.83* (1.70)	6.54* (1.79)	5.88* (1.33)
R^2	.1872	.3088	.2531	.2829	.3595

Notes: Author's calculations from NIDS (2008). The sample consists of married males 25-64 years of age.

5. Conclusions

This paper explores the link between marital sorting and the intergenerational transmission of economic status. We show that the tendency of individuals to choose a spouse with similar earnings potential can have revealing implications for the analysis of intergenerational inequality. Building on the seminal contributions by Lam and Schoeni (1993, 1994), the paper offers a theoretical framework that shows how earnings of individuals can be more highly correlated to parents-in-law's schooling than to own parent's schooling. The relative magnitude of the apparent effects on individuals' earnings of fathers' education as compared to father-in-laws' education, with or without controls for own schooling, is linked to the characteristics of

South Africa's labour markets. In particular, the paper shows that the results can be attributed to a high degree of assortative mating and to high levels of father-daughter intergenerational economic persistence.

The results offered in the paper can be replicated in other countries where similar datasets are available. Comparing evidence from countries with different labour market institutions, degrees of assortative mating, and levels of cross-sectional inequality could provide valuable insights on the "transmission channels" in the reproduction of inequality, especially for the less studied developing economies.

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