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Financial development and intergenerational education mobility

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Abstract

Using years of education as a measure of status, we study the relationship between financial development and intergenerational mobility, focusing on human capital investments boosted by financial deepening. We consider a set of indices to capture different components of the overall intergenerational education mobility. Using a sample of 39 countries, we find that financial development is related to structural mobility but not to exchange mobility. In particular, while we detect an inverted U-shaped relationship between financial development and structural mobility, we do not find any significant relationship with exchange mobility.
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1. Introduction

It is widely recognized that capital market imperfections constitute a potentially important mechanism affecting intergenerational status persistency. In particular, financial imperfections arising from informational asymmetries and transaction costs produce credit constraints that can affect the investment choices in human and/or physical capital. By easing financial frictions and hence improving the access of individuals and entrepreneurs to external finance, financial development may improve the allocation of capital through efficient investment and equalize opportunities (Heckman and Mosso, 2014; Jeong and Townsend, 2008; Galor and Moav, 2004; Galor and Zeira, 1993; Banerjee and Newman, 1993; Greenwood and Jovanovic, 1990). The final effect in terms of inequality will depend on which part of the population is more financially constrained. If credit constraints are particularly binding for small enterprises and the poor that lack collateral, credit histories, and connections, the easing of financial frictions will allow more poor people and entrepreneurs to obtain external finance and will decrease inequality. However, the presence of constraints is not necessarily synonymous with subotpimal level of investment of the poor. As an example consider the case of human capital investment. In this setting, parents must choose the optimal level of investment in education for their children. Optimally, parents should invest more when their investment is more productive. If children skills are affected by parental skills and, more generally, by environmental factors, more educated parents may face a steeper expected income growth (higher investment productivity) and thus a higher probability of being financially constrained. That is, their high optimal level of investment in education might not be affordable given the family current resource level. In this case, a relaxation of financial constraints will increase intergenerational income dispersion (Heckman and Mosso, 2014). Accordingly, the empirical evidence on the link between financial development and income inequality is controversial (negative effect: Beck et al. (2007), Clarke et al. (2006); positive effect: Gimet and Lagoarde-Segot (2011), Rodríguez-Pose and Tselios (2009), Roine et al. (2009); non monotonic effect: Jauch and Watzka (2016), Kim and Lin (2011).

In this paper we focus on the more primitive concept of equality of opportunities (Chetty et al., 2014; Corak, 2013; Roemer, 2009) analyzing the relationship between financial development and intergenerational mobility. Intergenerational mobility refers to the relationship between the socio-economic status of parents and that of their adult offsprings. The socioeconomic status can be measured in a variety of ways: by family income, individual earnings, education, and composite occupation-based indices.

Traditionally, in the sociological literature, intergenerational status transmission has been studied using composite measures of class standing. Starting from Duncan (1961) a variety of com-

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posite indices have been proposed, but there has generally been no consensus on the best measure of occupational status. More recently, economists have been focusing on long-run average income or earnings.[1] Ideally, earnings mobility should be measured in terms of permanent or long run earnings, but most survey data-sets covering two generations do not provide information allowing the calculation of lifetime earnings for both parents and children. Since lifetime incomes for both generations are rarely observed, proxies such as single current earnings or average earnings over multiple years have been used. Consequently, cross country income mobility comparisons made using income proxies are affected by measurement errors. Thus, it is difficult to distinguish if the empirical findings are the result of data reliability or reflect true differences in mobility patterns (Savegnago, 2017).

We analyze the relationship between financial development and intergenerational status transmission measuring status in terms of education attainment as defined by the number of years of schooling. As stressed by Blanden (2013), Black and Devereux (2010), and Hertz et al. (2007) the advantages of measuring status in terms of years of schooling are multiple. First, information on education achievements across generations are much widely available. Second, education has advantages over earnings or occupational status indices in terms of estimation. In particular, the number of years of formal schooling is a relatively unambiguous concept both in terms of cross-country comparability and in terms of recall-based quality of information collected. Moreover, since formal schooling is fixed once an individual reaches adulthood, it makes possible to obtain long time-series of cohort-specific mobility estimates using survey data on a single cross section of adults. Third, there is a theoretical relationship between the intergenerational transmission of education and long-run average income that is affected by the existence of credit constraints. Specifically, starting from Becker and Tomes (1986), economists have developed models explaining the parent–child status transmission in terms of investment in children's human capital.

In this strand of literature, the existence of constraints on financing investments in children's human capital generates a positive effect of parents' earnings on children's earnings. In other words, in these models financial developments shapes the persistence of income across generations through human capital accumulation or education attainments. The theoretical connection between financial development and human capital investment reinforces our choice of a measure of educational attainment as a measure of intergenerational status in order to analyze the relationship between financial development and intergenerational status transmission.

Empirically, economists have primarily analyzed the intergenerational status transmission using estimates of parent–child long-run earnings correlations or elasticities. To better understand the relationship between income and education it is instructive to look at the relation between the intergenerational coefficient of income elasticity and the coefficient from a regression of adult off-springs education on parental education. Let β_y be the slope coefficient from a regression of children long-run log-earnings on parental log-earnings and β_S the parameter from a regression of children education against parental education. Adding a model of long-run income determination in each generation as a function of education we obtain,

$$\beta_y = \frac{p_1}{p_0}\beta_S$$

where p_1 and p_0 are, respectively, the regression coefficient of long-run parental income (y_0) on parental education (s_0), and of long-run children's income (y_1) on children's education (s_1).[2] The above relation clarifies the connection between long-run income and education regression coefficients.

In this paper, using years of education as a measure of status, we study the relationship between financial development and intergenerational mobility. Acknowledging the complexity of the mobility concept, we consider a set of indices to capture the different components of intergenerational education mobility. In particular, we employ a set of indices representing distinct concepts of education mobility. Additionally, we use a set of proxies of financial development ranging from a more simple measure of depth of financial institutions to wider measures of depth of the overall financial system. We empirically analyze the relationship between financial development and intergenerational education mobility using a sample of 41 countries obtained matching the parent–child education data on 42 countries collected by Hertz et al. (2007) with the Global Financial Development Database (*GFDD*) provided by the World Bank (Cihak et al., 2012).

Summarizing, the contribution of this paper is threefold. First, using data on years of education and acknowledging the multiple dimensions of the mobility concept, our approach allows to differentiate between different concepts of mobility through a set of indices capturing distinct components of the overall intergenerational mobility. We believe that specifying the different components of mobility is important to understand the channels through which financial development can be related to intergenerational mobility. Second, we use a wide sample of countries to analyze empirically the relationship between financial development and intergenerational mobility. Finally, we find evidence suggesting that financial development is related to structural mobility but not to exchange mobility. In particular, our analyses indicate the existence of an increasing and concave relationship between financial development and structural mobility.

2. Mobility measures

Socioeconomic mobility is a multifaceted concept, difficult to define and to measure. This is in contrast with the concept of income inequality for which there is agreement on the correct theoretical procedures to measure it, and how to go from theory to empirical applications. On the contrary, there does not

[1] See Solon (2002) and Solon (2004).

[2] The reported relation can be decomposed introducing a term capturing the intergenerational transmission of abilities $\phi = \frac{cov(s_1,u_0)}{var(u_0)}$, where u_0 is the error in the regression of parents' income on parents' education (Hertz et al., 2007). We obtain, $\beta_y = \frac{p_1}{p_0}\beta_S R^2 + (1 - R^2)p_1\phi$.

exist a unified concept of intergenerational mobility. Given two vectors **x** and **y** containing information about a relevant observable indicator of the status of a population of individuals over two generations, the joint distribution of the status of fathers and children in a population contains information about different aspects of the mobility in a society. Precisely, the interplay between the distributions of **x** and **y** can be described by two quite different concepts: (1) *structural mobility* refers to how far apart the vector **x** is from the vector **y**; (2) *exchange mobility* refers to the association between fathers and children statutes in the society, that is to how families interchange their relative positions.[3]

To better understand the underlying dimensions of intergenerational mobility we can look at a simplified setting where for a given population there are only two possible statuses: high and low. The joint probability distribution representing the status of parents and children can be represented by the following two-by-two table

	S_h^P	S_l^P	Marginal children
S_h^C	p_{hh}	p_{hl}	p_h^c
S_l^C	p_{lh}	p_{ll}	p_l^c
Marginal parents	p_h^p	p_l^p	1

where $S_h^P = 1$ if the status of parents S^P is greater than a chosen cutoff $\bar{S}^P$ (conversely, let $S_h^C = 1$ if the status of children S^C is greater than a chosen cutoff $\bar{S}^C$). Then, p_{ij} represents the probability of children having status i with corresponding parents having status j (with $i = h, l$ and $j = h, l$); and p_i^c p_j^p are the related marginal distributions. In any two-by-two table, since there are 4 probabilities summing to one, we need to know only 3 parameters to describe the table. Each marginal can be described by one parameter since it sums to one. Thus, if we fix the marginals, there is only one parameter left to characterize the degree of association. In this setting, structural mobility measures how far is p_i^c from p_j^p and exchange mobility measures how parents and children statuses are associated given fixed marginal distributions. In this simplified case of a two by two joint status distribution, if the marginals are fixed, there is only one parameter left to characterize exchange mobility. Commonly used measures of association are the odds ratio (in our example $OR = \frac{p_{hh} p_{ll}}{p_{lh} p_{hl}}$) or p_{ll} (p_{hh}), the probability that parents in the low (high) status have children in the low (high) status.

But in the real world we never compare two joint status probability distributions with equal marginals. Suppose that you have two tables for two countries A and B. If the marginal status distributions of A and B are not equal, all indices obtained using the joint probability distribution confound structural and exchange mobility. To make exchange mobility comparisons one can eliminate the effect of the marginals, redefining the statuses in relative terms and working with implied ranks instead of statuses. Let $R_h^P = 1$ if the status of parents S^P is greater than the median, and $R_l^P = 1$ if the status of parents S^P is lower than the median (conversely, let $R_h^C = 1$ if the status of children S^C is greater than the median, and $R_l^C = 1$ if the status of children S^C is lower than the median). Working with quantiles we obtain a setting where the marginals are equal (in our example $p_i^c = p_j^p = 0.5$), and thus we can compare societies in terms of pure positional change. Quantile matrices have been extensively used in the mobility research area to summarize joint status distributions and to compare such distributions across time or countries. The alternative approach is to summarize bivariate joint status distributions by mobility indices. Jantti and Jenkins (2013) provide a review of mobility concepts and related measurement methods both within and between generations.

We follow the approach of summarizing joint status distributions by mobility indices. We acknowledge that empirically mobility indices that give relatively more weight to the structural component of mobility, may provide a substantially different view than indices that give greater weight to the exchange component. Therefore, to analyze the relationship between financial development and intergenerational mobility we introduce a set of indices capturing different mobility concepts.

We start introducing two indices focusing respectively on the *structural* and the *exchange* component of intergenerational education mobility.

First, we introduce an index that is more directly related to the concept of stochastic dominance between distributions. Let $k = 1, \ldots, m$ be the number of years of schooling. After identifying a common support in terms of k for the distributions of parents and offsprings, we compute the cumulative empirical distribution functions. Let $G(k)$ and $F(k)$ the cumulative distribution functions of parents and offsprings respectively. Inspired by the Kolmogorov–Smirnov statistic, we construct a mobility index computed as the average distance between the cumulative empirical distribution functions of parents and offsprings. Thus, for each country and cohort M^S is given by,

$$M^S = \frac{1}{m}\sum_{k=1}^{m}|G(k) - F(k)|$$

Given a society of n individuals and the related vectors $x_i = (x_1, \ldots, x_n)$ and $y_i = (y_1, \ldots, y_n)$ representing the indicator of education status of children and parents, the index measures how far apart are the corresponding marginal distributions. That is, M^S measures the intergenerational distance between the marginal distributions of education levels and thus gives information on the extent of structural mobility.

Second, to obtain an exchange mobility measure, we consider an ordinal mobility index using ranks instead of the observed education status of children and parents. Let r_x and r_y be the rank variables corresponding to the observed education status of offsprings and parents (where for each individual i in a country-cohort group, the rank is its relative position in the group to which he belongs.). For each country and for each cohort, we compute the non-parametric index of association of Spearman,

$$S = \frac{cov(r_x, r_y)}{\sigma(r_x)\sigma(r_y)}$$

[3] In this paper we will use exchange, positional, and transfer mobility as synonyms.

Then, we calculate the following mobility index,

$$M^{Ea} = 1 - S$$

The ordinal index M^{Ea} is a measure of relative positional mobility. It is relatively insensitive[4] to differences in the marginal status distributions of children and parents, and thus it is a mobility measure mainly affected by the exchange component of mobility.[5] While ranks are uniquely determined in the case where there are no ties in the marginal distributions, there is no single accepted way of defining ranks in the presence of ties. In this paper midranks are assigned to tied observations. We can define an alternative ordinal index measuring positional mobility using the empirical cumulative distribution functions of parents and children to define ranks. For each country, considering the cohort with n individual observations and letting y_i be the number of years of schooling of child i and x_i the corresponding parental number of years of schooling, we define M^{Eb} as follows,

$$M^{Eb} = \frac{1}{n}\sum_{i=1}^{n}|G(y_i) - F(x_i)|$$

Finally, for completeness, we consider the absolute mobility characterized by Fields and Ok (1996). Defining mobility for each individual in terms of "distance" between origin and destination status (or a function of the status), intergenerational mobility can be obtained as an aggregate measure of the changes in status experienced by each individual within the society with respect to the parents' status. The class of indices obtained using this approach represents total mobility arising from both transfer and growth mobility. The choice of the metric for distance and of the function of status characterizes the different indices. Following Fields and Ok (1996) we compute the City Block distance between the child and the parent education level. For a given country, consider the cohort with n individual observations, M^T is given by,

$$M^T = \frac{1}{n}\sum_{i=1}^{n}|y_i - x_i|$$

The index M^T is a nondirectional absolute measure of total intergenerational mobility. That is, the index is an aggregate measure of status variations between generations. Dividing by n the index is converted to a per capita basis in order to allow mobility comparisons for groups consisting of different numbers of people or for surveys consisting of different numbers of respondents.

3. Data and econometric methodology

Our dependent variable is an intergenerational mobility index (M^γ, $\gamma = S, Ea, Eb, T$) computed using the Hertz et al. (2007) database. Hertz et al. (2007) database collects parent–child education data on 42 countries drawn from surveys conducted between 1985 and 2004.[6] In the database education is coded as the number of years of schooling associated with the highest grade completed assuming no grade repetition. The global micro-data file contains for each country the survey year, and for each individual surveyed the age, the number of years of schooling, and the number of years of schooling of the parents.[7] When, for one country, several surveys are available, we keep the most recent one. For each country, we construct 10 five-year birth cohorts based on the reported respondent ages ranging from 20 to 69 years. In some surveys the maximal age is 64 or 65 and thus we get only 9 five-year birth cohorts.[8]

For each country, using the survey year and the age of each individual, we obtain, for each cohort, a five year time interval[9] spanning the corresponding years of birth of the individuals in the cohort. We use this time interval to identify the relevant temporal horizon over which to collect data on the explanatory variables. Since Becker and Tomes (1986), financial market frictions have been considered a critical ingredient to explain intergenerational status persistence due to their influence on individual investment in human capital accumulation (schooling). Working with child-parent data on schooling, what matters to understand the relationship between intergenerational mobility and financial development, is the degree of financial development at the time when schooling choices are taken. In principle, having, for each country, a full coverage of historical data on the official entrance age to primary education and on the duration of compulsory education, we could have derived the relevant time period for schooling choices. Unfortunately the schooling data collected by the World Bank do not provide the coverage required by our sample. Alternatively, we identify the relevant time interval as follows,

$$Time_{ijt} = Birth_{ijt} + 6 + MedianEduc_{ij}$$

where the index (i, j, t) denote respectively the country, the cohort and the time, *Birth* is the birth date, and *MedianEduc* is the median number of years of schooling. We generally assume that children enter primary education at the age of 6, and we proxy the duration of compulsory education by the median number of years of schooling of the reference group.

We use the Global Financial Development Database (*GFDD*) provided by the World Bank (Cihak et al., 2012) to get data on financial systems over time. The database contains data on financial system characteristics for 205 countries from 1960 to 2010. The database collects measures of size (or depth), accessability, efficiency and stability of financial systems over time. These

[4] The index it is insensitive to differences in the marginal distributions if there are not ties.

[5] See D'Agostino and Dardanoni (2009) for a characterization of the index.

[6] Specifically Hertz et al. (2007) build a database drawing information from World Bank Living Standards Measurement Surveys (LSMS), surveys affiliate with the European Social Survey (ESS), The International Social Survey Program (ISSP), and the International Adult Literacy Survey (IALS).

[7] See Hertz et al. (2007) for a detailed discussion about the construction of the database starting from country surveys.

[8] In one country, Malaysia, the maximal age is 49. Thus, we obtain only 6 birth cohorts.

[9] For some countries the maximum age is 65 instead of 69. In these cases we build only 9 cohorts, and the oldest cohort spans six years.

Table 1
Total mobility measured by M^T including adjustments for cohort effects. Robust standard errors in round parentheses.

Dependent variable M^T	PC	FD1	FD2	PC	FD1	FD2
Pared-bar	−0.026***	−0.026***	−0.027***	−0.024***	−0.024***	−0.024***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
$GE2_p$	−0.385**	−0.410***	−0.402***	−0.254*	−0.271*	−0.268*
	(0.146)	(0.145)	(0.141)	(0.141)	(0.142)	(0.140)
GDP_{pc}	0.001	0.002	0.001	−0.002	−0.001	−0.002
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Fert. rate	−0.008*	−0.010***	−0.009**	−0.006	−0.007*	−0.007*
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Life exp.	0.042***	0.042***	0.042***	0.051***	0.052***	0.052***
	(0.009)	(0.010)	(0.010)	(0.011)	(0.012	(0.012)
cohort	0.001	0.002	0.001			
	(0.003)	(0.003)	(0.003)			
PC	0.056*			0.048		
	(0.0308)			(0.032)		
PC^2	−0.047*			−0.039		
	(0.026)			(0.028)		
FD1		0.060*			0.047	
		(0.032)			(0.033)	
$FD1^2$		−0.051**			−0.035	
		(0.023)			(0.025)	
FD2			0.041*			0.037*
			(0.021)			(0.022)
$FD2^2$			−0.033***			−0.027***
			(0.010)			(0.011)
Constant	0.097	0.093	0.100	0.015	0.018	0.019
	(0.079)	(0.085)	(0.081)	(0.087)	(0.094)	(0.091)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE				Yes	Yes	Yes
Observations	184	184	184	184	184	184
N. Countries	39	39	39	184	184	184
Adj. R_2	0.601	0.597	0.601	0.639	0.634	0.638

* $p<0.1$.
** $p<0.05$.
*** $p<0.01$.

four characteristics are measured both for financial institutions and financial markets. In our analyses we mainly use measures of financial institutions depth to maximize the sample coverage. In particular, we collect data measuring the ability of financial intermediaries to channel savings to investors. We use a measure of the activity of financial intermediaries in providing resources to the private sector, namely private credit by deposit money banks and other financial intermediaries (*PC*). Finally, we build variables (*FD1, FD2*) representing the average depth of the overall financial system. The variables are computed as an average of a measure of depth of financial institutions and a measure of depth of financial markets whenever possible. When there are no data on financial markets *FD1* and *FD2* measure the depth of financial institutions. The overall depth of financial markets is either the size of the stock market (in the case of *FD1*), or it is obtained summing an indicator of the size of the stock market and an indicator of the size of the private bond market (in the case *FD2*).

Merging the education data on parents and offsprings obtained using the Hertz et al. (2007) database with the *GFDD* database, we obtain a country-cohort sample of 41 countries and 393 observations. After accounting for missing data, we are left with 39 countries and 184 observations.

We exploit the panel structure of our database estimating a model where, for each country (i) and each cohort (j), a proxy of intergenerational mobility (M^{γ}, $\gamma = S, Ea, Eb, T$) is regressed on a proxy of financial development (FD) and a set of control variables (X), including a constant term:

$$M^{\gamma}_{ij} = \alpha + \beta_1 FD_{ij} + \beta_2 X_{ij} + \nu_i + \eta_j + \epsilon_{ij}$$

where ν_i and η_j represent respectively country and cohort fixed effects. X includes variables capturing the country level of development and the characteristics of the distribution of parental education. Specifically, we employ GDP_{pc} measuring the *GDP* pro-capite evaluated at constant (2010) US dollars, the number of births per woman (*Fertility-Rate*), and the life expectancy at birth (*Life-Expectancy*). Additionally, we use an aggregate variable, (*Stage-Dev1, Stage-Dev2*), obtained from a principal component analysis (PCA) using the previous variables representing the stage of development of a country. To control for the characteristics of the distribution of parents' education we use *Pared-bar*, representing the average of the parent education distribution, and a measure of the inequality of the distribution

Table 2
Total mobility measured by M^T, including cohort dummies and proxies for the stage of development. Robust standard errors in round parentheses.

Dependent variable M^T						
	PC SD1	FD1 SD1	FD2 SD1	PC SD2	FD1 SD2	FD2 SD2
Pared-bar	−0.023***	−0.022***	−0.023***			
	(0.004)	(0.004)	(0.004))			
$GE2_p$	−0.756***	−0.755***	−0.770***	−0.742***	−0.736***	−0.763***
	(0.120)	(0.115)	(0.119)	(0.138)	(0.147)	(0.139)
Stage-Dev1	0.048***	0.054***	0.053***			
	(0.010)	(0.008)	(0.008)			
Stage-Dev2				0.035**	0.046***	0.043***
				(0.015)	(0.013)	(0.013)
PC	0.064*			0.090**		
	(0.033)			(0.039)		
PC^2	−0.052*			−0.072**		
	(0.030)			(0.029)		
FD1		0.071**			0.097**	
		(0.035)			(0.045)	
$FD1^2$		−0.050*			−0.062**	
		(0.028)			(0.030)	
FD2			0.050**			0.063**
			(0.021)			(0.031)
$FD2^2$			−0.036***			−0.043***
			(0.011)			(0.014)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.353***	0.356***	0.362**	0.227***	0.240***	0.242***
	(0.034)	(0.038)	(0.038)	(0.025)	(0.029)	(0.029)
Observations	184	184	184	184	184	184
Number of countries	39	39	39	39	39	39
Adj. R^2	0.575	0.572	0.573	0.363	0.358	0.342

* $p<0.1$.
** $p<0.05$.
*** $p<0.01$.

of parent education. We use the Gini index ($Gini_p$) or the Generalized Entropy index with parameter $a=2$ ($GE2_p$).[10] The two inequality indices differ in their sensitivities to income differences in different parts of the distribution. The Gini index is more sensitive to income differences about the middle of the distribution (the mode), while *GE2* is more sensitive to income differences at the top of the distribution. In Appendix A, Table 9 provides a detailed description of the variables and data sources, Table 10 provides descriptive statistics of the variables used in the estimations conveniently scaled, and Table 11 lists the countries used in the analyses.

In all regressions standard errors are adjusted for clustering at the country level and are robust to both heteroskedasticity and intra-group correlation.

4. Results

4.1. Total mobility

Table 1 and Table 2 show the results obtained measuring total mobility using M^T, the City Block distance between the child and the parental education level where the parental education level is defined as the average number of schooling years of the parents. The columns in Table 1 differ in the way the cohort effect is taken into account in the estimation. Precisely, in the first three columns, we assume a linear effect and use the variable *cohort*, while in the last three columns we estimate this effect non parametrically introducing cohort dummies. In Table 2, we replace the control variables related to the stage of development of a country with aggregate variables (*Stage-Dev1, Stage-Dev2*), obtained from a PCA using the previous variables.

The proxies used to measure the level of financial development (*PC, FD1*, and *FD2*) are generally non linearly associated with aggregate intergenerational mobility. In particular, we introduced a squared term to capture possible non linearities. The estimated relationship between financial development and total absolute mobility appears to be concave. That is, financial development is generally positively associated with total mobility but the positive association decreases as financial development increases. Moreover, analyzing the marginal effects, we can see that there a threshold level over which an increase of financial development is negatively associated with total mobility. As an example, in Table 1 column 1, the cut-off point for *PC* is 0.59 corresponding to the 79% percentile.

In all regressions the variables representing the distribution of parents education (*Pared-bar* and $GE2_p$) are negatively asso-

[10] The indices are computed using the ineqdec0 Stata module provided by Jenkins (1999).

Table 3
Structural mobility measured by M^S including adjustments for cohort effects. Robust standard errors in round parentheses.

Dependent variable M^S						
	PC	FD1	FD2	PC	FD1	FD2
Pared-bar	−0.034***	−0.033***	−0.034***	−0.031***	−0.031***	−0.032***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$GE2_P$	−0.340**	−0.360***	−0.352***	−0.168	−0.173	−0.173
	(0.119)	(0.118)	(0.112)	(0.141)	(0.147)	(0.141)
GDP_{pc}	0.003	0.005	0.004	−0.001	0.001	−0.000
	(0.008)	(0.008)	(0.008)	(0.006)	(0.006)	(0.006)
Fert. rate	−0.014***	−0.016***	−0.016***	−0.011**	−0.012**	−0.012**
	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Life exp.	0.044***	0.045***	0.045***	0.057***	0.059***	0.058***
	(0.009)	(0.010)	(0.010)	(0.012)	(0.013)	(0.013)
cohort	0.003	0.005	0.004			
	(0.004)	(0.004)	(0.004)			
PC	0.075**			0.066*		
	(0.035)			(0.037)		
PC^2	−0.053*			−0.043		
	(0.031)			(0.033)		
FD1		0.079**			0.064*	
		(0.035)			(0.037)	
$FD1^2$		−0.056**			−0.036	
		(0.025)			(0.028)	
FD2			0.057**			0.053**
			(0.024)			(0.026)
$FD2^2$			−0.039***			−0.031**
			(0.011)			(0.013)
Constant	0.101	0.090	0.103	0.005	−0.000	0.005
	(0.081)	(0.087)	(0.084)	(0.091)	(0.099)	(0.098)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE				Yes	Yes	Yes
Observations	184	184	184	184	184	184
N. Countries	39	39	39	184	184	184
Adj. R_2	0.608	0.606	0.606	0.653	0.651	0.651

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

ciated with total mobility. The first result is intuitive: since the level of education cannot increase indefinitely, the higher the average level of education of parents the lower are the margins for improvement of children. Less clear-cut is the detected negative association between the measure of education inequality of parents and the measure of intergenerational mobility. Empirically both positive and negative correlation have been observed. Hassler et al. (2007) provide an equilibrium model with imperfect capital markets to explain the relationship between inequality and intergenerational mobility. In their model with dichotomous human capital level (skilled or unskilled), intergenerational mobility is defined as the proportion of children of unskilled parents becoming skilled. Thus, their concept of mobility is more strictly related to our measures of total and structural mobility. They show that higher inequality[11] may have two opposite effects. On the one hand, higher inequality increases the potential gains form education and, thus, the incentive to invest in education will be higher. This positive effect is called the *incentive effect*. On the other hand, higher inequality reduces the ability of non-educated parents (unskilled with low wages) to pay for education. This negative effect is named the *distance effect*. Empirically the correlation between inequality and intergenerational mobility can be either positive or negative depending on which effect will prevail. They show that changes related to the labor market, such labor productivity, lead to a positive correlation between inequality and intergenerational mobility, while changes in the educational system lead to a negative correlation between inequality and mobility. Our result is in line with this last setting.

The other control variables have the expected effect: the fertility rate, related to the availability of resources for investments in children education, is negatively associated with total mobility, while life expectancy, affecting the length of the horizon over which an investment in human capital can produce its effects, is positively associated with total mobility. When we introduce the aggregate variables capturing the stage of development of a country (*Stage-Dev1, Stage-Dev2*), those variables are highly

[11] In their model higher inequality is modeled in terms of wage differential between skilled and unskilled workers. In the contest of this paper, we can think that larger departures in the education levels of the parents will be associated with greater wage differentials.

Table 4
Structural mobility measured by M^S, including cohort dummies and proxies for the stage of development. Robust standard errors in round parentheses.

Dependent variable M^S	PC SD1	FD1 SD1	FD2 SD1	PC SD2	FD1 SD2	FD2 SD2
Pared-bar	−0.030***	−0.029***	−0.030***			
	(0.004)	(0.004)	(0.004)			
$GE2_p$	−0.688***	−0.668***	−0.695***	−0.670***	−0.644***	−0.686***
	(0.126)	(0.114)	(0.121)	(0.199)	(0.219)	(0.205)
Stage-Dev1	0.062***	0.069***	0.067***			
	(0.012)	(0.009)	(0.010)			
Stage-Dev2				0.044**	0.058***	0.054***
				(0.018)	(0.015)	(0.016)
PC	0.084**			0.118**		
	(0.038)			(0.048)		
PC^2	−0.059			−0.087**		
	(0.036)			(0.035)		
FD1		0.091**			0.125**	
		(0.038)			(0.053)	
$FD1^2$		−0.053*			−0.069**	
		(0.031)			(0.033)	
FD2			0.067***			0.084***
			(0.024)			(0.038)
$FD2^2$			−0.042***			−0.051***
			(0.013)			(0.016)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.367***	0.368***	0.378**	0.199***	0.215***	0.218***
	(0.033)	(0.037)	(0.038)	(0.028)	(0.031)	(0.032)
Observations	184	184	184	184	184	184
Number of countries	39	39	39	39	39	39
Adj. R^2	0.596	0.600	0.593	0.339	0.347	0.316

* $p<0.1$.
** $p<0.05$.
*** $p<0.01$.

positively significant and the general picture does not change. For robustness, we replicate the analysis using $Gini_p$ to control for the level of inequality of the parents education distribution and we get results qualitatively similar.[12]

4.2. Structural and exchange mobility

To focus on the relationship between financial development and structural intergenerational mobility we introduced the index M^S, the average distance between the empirical marginal distribution of parents and offsprings. Tables 3 and 4 show the results of regressing M^S on the alternative proxies for financial development and control variables taking into account country fixed effects and cohort effects. The results are qualitatively similar to those obtained using the measure of total intergenerational mobility M^T. The three proxies for financial development (*PC, FD1, FD2*) are non linearly associated with structural mobility. Precisely, there is a concave relationship between structural mobility and financial development. The relationship is stronger when financial development is proxied by the most extensive measure of the depth of the overall financial system *FD2*.

To measure exchange mobility we introduced the index M^{Ea} calculated as one minus the Spearman index of association among the ranks of parents and children. As before we report a set of estimations where the cohort effect is controlled parametrically and non parametrically. Moreover, we report estimations where we replace the single control variables related to the stage of development of a country with the aggregate variables (*Stage-Dev1*, *Stage-Dev2*). Tables 5 and 6 show the analyses where exchange mobility is measured using M^{Ea}.

In the tables the proxies for financial development are entered linearly. In unreported regressions, available upon request, we added a squared term that was always not significant. Thus, we report the tables with the linear specification. In general, the level of financial development is not significantly associated to exchange mobility independently of the specific measure used to account for it. The control variables, when significant, have the expected signs: the *Fertility-rate* is negatively associated to exchange mobility while GDP_{pc} and the proxies for the stage of development are positively associated with exchange mobility. Interestingly, the variable representing the inequality of the parents education distribution $GE2_p$, when significant, is positively associated with exchange mobility. However, it is possible that this result is an artefact related to the presence of ties. In fact, the variable years of education is a discrete

[12] The results are available upon request.

Table 5
Exchange mobility measured by M^{Ea} including adjustments for cohort effects. Robust standard errors in round parentheses.

Dependent variable M^{Ea}						
	PC	FD1	FD2	PC	FD1	FD2
Pared-bar	0.015	0.015	0.016	0.016	0.016	0.018
	(0.021)	(0.023)	(0.022)	(0.021)	(0.023)	(0.023)
$GE2_p$	0.918	0.831	0.797	1.019	0.931	0.907
	(0.897)	(0.862)	(0.858)	(0.921)	(0.882)	(0.864)
GDP_{pc}	0.044**	0.044**	0.046**	0.040**	0.040**	0.043**
	(0.019)	(0.019)	(0.020)	(0.019)	(0.019)	(0.019)
Fert. rate	−0.030*	−0.034**	−0.036**	−0.027*	−0.031**	−0.033**
	(0.016)	(0.015)	(0.015)	(0.016)	(0.015)	(0.015)
Life exp.	0.001	−0.001	−0.001	0.006	0.004	0.005
	(0.037)	(0.037)	(0.038)	(0.037)	(0.037)	(0.037)
cohort	0.015	0.019	0.021			
	(0.016)	(0.016)	(0.017)			
PC	−0.047			−0.052		
	(0.058)			(0.058)		
FD1		−0.017			−0.021	
		(0.067)			(0.068)	
FD2			0.003			0.003
			(0.059)			(0.060)
Constant	0.453	0.453	0.438	0.511*	0.539**	0.536**
	(0.323)	(0.324)	(0.332)	(0.264)	(0.253)	(0.262)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE				Yes	Yes	Yes
Observations	184	184	184	184	184	184
N. Countries	39	39	39	184	184	184
Adj. R_2	0.083	0.077	0.076	0.076	0.069	0.067

*$p < 0.1$.
**$p < 0.05$.
***$p < 0.01$.

Table 6
Exchange mobility measured by M^{Ea}, including cohort dummies and proxies for the stage of development. Robust standard errors in round parentheses.

Dependent variable M^{Ea}						
	PC SD1	FD1 SD1	FD2 SD1	PC SD2	FD1 SD2	FD2 SD2
Pared-bar	0.014	0.014	0.017			
	(0.021)	(0.022)	(0.023)			
$GE2_p$	1.614**	1.546**	1.575**	1.616**	1.546**	1.577**
	(0.761)	(0.747)	(0.718)	(0.776)	(0.763)	(0.736)
Stage-Dev1	0.048	0.054	0.058*			
	(0.034)	(0.034)	(0.032)			
Stage-Dev2				0.059	0.064	0.070
				(0.043)	(0.042)	(0.042)
PC	−0.054			−0.055		
	(0.058)			(0.058)		
FD1		−0.032			−0.035	
		(0.038)			(0.053)	
FD2			−0.001			−0.002
			(0.058)			(0.058)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.468***	0.475***	0.463**	0.552***	0.560***	0.560***
	(0.106)	(0.116)	(0.109)	(0.071)	(0.074)	(0.072)
Observations	184	184	184	184	184	184
Number of countries	39	39	39	39	39	39
Adj. R^2	0.073	0.067	0.063	0.077	0.071	0.067

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table 7
Exchange mobility measured by M^{Eb} including adjustments for cohort effects. Robust standard errors in round parentheses.

Dependent variable M^{Eb}						
	PC	FD1	FD2	PC	FD1	FD2
Pared-bar	0.006	0.006	0.007	0.005	0.005	0.006
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
$GE2_p$	−0.150	−0.180	−0.196	−0.176	−0.206	−0.215
	(0.164)	(0.160)	(0.162)	(0.177)	(0.175)	(0.172)
GDP_{pc}	0.005	0.005	0.006	0.005	0.005	0.006
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Fert. rate	−0.008**	−0.009**	−0.010***	−0.009**	−0.010**	−0.010**
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
Life exp.	0.018*	0.017*	0.017	0.016	0.016	0.016
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
cohort	0.007	0.008*	0.010*			
	(0.005)	(0.005)	(0.005)			
PC	−0.017			−0.019		
	(0.015)			(0.015)		
FD1		−0.008			−0.011	
		(0.017)			(0.017)	
FD2			0.002			−0.000
			(0.015)			(0.016)
Constant	0.077	0.078	0.071	0.152*	0.162**	0.161**
	(0.091)	(0.094)	(0.097)	(0.077)	(0.075)	(0.077)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE				Yes	Yes	Yes
Observations	184	184	184	184	184	184
N. Countries	39	39	39	184	184	184
Adj. R_2	0.164	0.154	0.151	0.156	0.145	0.139

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table 8
Exchange mobility measured by M^{Eb}, including cohort dummies and proxies for the stage of development. Robust standard errors in round parentheses.

Dependent variable M^{Eb}						
	PC SD1	FD1 SD1	FD2 SD1	PC SD2	FD1 SD2	FD2 SD2
Pared-bar	0.005	0.005	0.006			
	(0.006)	(0.006)	(0.006)			
$GE2_p$	−0.230	−0.253*	−0.245*	-0.228	−0.251*	−0.242*
	(0.139)	(0.137)	(0.130)	(0.139)	(0.137)	(0.130)
Stage-Dev1	0.028***	0.031***	0.032***			
	(0.009)	(0.009)	(0.009)			
Stage-Dev2				0.033***	0.036***	0.037***
				(0.011)	(0.011)	(0.012)
PC	−0.020			−0.020		
	(0.015)			(0.014)		
FD1		−0.009			−0.009	
		(0.017)			(0.016)	
FD2			−0.001			−0.001
			(0.015)			(0.015)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.241***	0.242***	0.239***	0.273***	0.276***	0.276***
	(0.032)	(0.034)	(0.033)	(0.021)	(0.024)	(0.023)
Observations	184	184	184	184	184	184
Number of countries	39	39	39	39	39	39
Adj. R^2	0.159	0.145	0.141	0.165	0.150	0.146

*p < 0.1.
**p < 0.05.
***p < 0.01.

variable assuming a limited number of values (in our sample 0, 1, 2, ..., 21). Therefore, the distribution of years of education in a population presents a large number of ties. Liu (2017) shows that the Spearman index decreases as the percentage of ties increases. In our sample the percentage of ties in the parent education distribution is positively correlated with the degree of inequality. Thus, we get a positive association between inequality and exchange mobility measured as M^{Ea} (that is, one minus the Spearman index). To overcame this problem we introduced the measure of positional change M^{Eb}. This index is an alternative ordinal index where ranks are defined in terms of cumulative distribution functions. Tables 7 and 8 show the results obtained using as a dependent variable M^{Eb}. As in the case of M^{Ea}, the proxies used to measure the level of financial development are not significantly associated to exchange mobility independently of the specific measure used to account for it. The control variables, when significant, have the expected signs: the *Fertility-rate* is negatively associated to exchange mobility while the proxies representing the stage of development are positively associated with exchange mobility. The inequality of the parental education distribution (when significant) is now negatively correlated with positional mobility.

For robustness, we replicate all the previous analysis using $Gini_p$ to control for the level of inequality of the parental education distribution and we get qualitatively similar results.[13]

5. Conclusions

In this paper we analyze the relationship between intergenerational mobility and financial development using years of education to measure the status of parents and their off-springs. We obtain a panel of 39 countries matching the parent–child education database collected by Hertz et al. (2007) with the Global Financial Development Database (*GFDD*) provided by the World Bank (Cihak et al., 2012).

Our analyses show how ambiguous can be to talk about intergenerational mobility without differentiating between the two concepts of structural and exchange mobility. Our results are in line with the conclusions of Checchi and Dardanoni (2003) who compare the performance of various mobility indices using real data, and show that various classes of mobility indices may have strikingly different behavior. In our sample, we detect a significant inverted *U*-shaped relationship between financial development and structural mobility but no association with exchange mobility. That is, the level of financial development can affect the marginal distributions but not the relative positions in the population. This result can help to qualify the effect of financial development. As stressed in the introduction, financial development should produce a relaxation of financial constraints allowing a more efficient level of investment in human capital. But the final effect in terms of intergenerational mobility and inequality depends on which part of the population is more financially constrained. Our results can be compatible with two different scenarios. First, we can consider the case where the relaxation of financial constraints affects equally all individuals in a population. In this case a higher level of financial development may induce higher investment in human capital across the population and thus be associated with an upward shift in the empirical distribution of years of education of children with respect to parents without any change in ranks. Second, we can consider the case where the relaxation of financial constraints is restricted to the upper part of the distribution. That is, the more educated people are those who benefit from financial development and again there is a shift in the marginal distribution of children with respect to parents without any change in ranks. From our analyses we are not able to disentangle the two previous cases, but we can exclude that financial development in our sample is associated with a relatively higher investment in human capital of the less educated people in the population.

We are aware that the individual investment in education and the related human capital accumulation is not the only channel through which financial development can affect intergenerational mobility and the distribution of income. Another avenue is the influence of financial deepening on the ability of firms to get external financing. That is, financial development, through enterprise credit, might allow a more efficient capital allocation across incumbents and new enterprises sustaining growth and lowering income inequality. While the theory makes ambiguous predictions about the relationship among the financial sector development as enterprise credit or household credit and the changes in income inequality, Beck et al. (2012), analyzing credit composition across countries and over time, provide evidence showing that enterprise credit reduces income inequality whereas household credit has no effect on it.

In this paper we are concerned with the study of the relationship between financial development and educational intergenerational mobility. Choosing to measure intergenerational mobility in terms of differences of education levels between parents and their adult off-springs allows us to focus on human capital investments boosted by financial deepening. We stress the importance of shifting the attention towards the relationship between financial development and intergenerational mobility to get insights on the equalization of opportunities related to the relaxation of financial constraints. In particular, measures of exchange intergenerational mobility are directly related to the concept of equality of opportunities. We highlight the multifaceted nature of the concept of intergenerational mobility, and show that accounting for the subdimensions of the mobility concept may give very different insights. Specifically, our evidence suggests that while financial sector deepening exhibits an inverted *U* shape relative to structural mobility, it is not significantly related to positional mobility.

Conflict of interest

None.

[13] The results are available upon request.

Appendix A.

Table 9
Variable description and data source.

Variable	Description	Data source
M^{γ}	Mobility index computed using education data on fathers and offsprings	Hertz et al. (2007) database
PC	Private credit by deposit money banks and other financial intermediaries	Global Financial development Database WB (Cihak et al., 2012)
FD1	Depth of the overall financial system: average of PC and stock market size	Global Financial development Database WB (Cihak et al., 2012)
FD2	Depth of the overall financial system: average of PC and financial market depth measured as sum of stock market size and private domestic bond market	Global Financial development Database WB (Cihak et al., 2012)
GDP_{pc}	GDP pro-capite evaluated at constant (2010) US dollars	World Development Indicators, WB Databank
Fertility rate	Number of births per woman	World Development Indicators, WB Databank
Life expectancy	Life expectancy at birth	World Development Indicators, WB Databank
Pared-bar	Average of the parent education distribution	Hertz et al. (2007) database
$Gini_p$	Gini index of the parent education distribution	Hertz et al. (2007) database
$GE2_p$	Generalized Entropy index with parameter $a=2$ relative to the parent education distribution	Hertz et al. (2007) database
cohort	variable identifying the cohort, (1, . . ., 10), from the most recent to the oldest	
Stage-Dev1	First component of PCA using GDP_pc, Fertility rate, Life expectancy	
Stage-Dev2	First component of PCA using GDP_pc, Fertility rate, Life expectancy, and Pared bar	

Table 10
Descriptive statistics for the 184 non missing observations of the sample.

Variable	Mean	St. Dev	Min	Max
Total index				
M^T	0.18	0.05	0.08	0.28
Structural index				
M^S	0.15	0.05	0.21	0.27
Exchange index				
M^{Ea}	0.44	0.12	0.11	0.70
M^{Eb}	0.23	0.03	0.13	0.33
Financial development				
PC	0.38	0.30	0.01	1.49
FD2	0.34	0.25	0.01	1.32
FD4	0.35	0.28	0.01	1.68
Control variables				
Pared-bar	6.53	3.63	0.29	13.13
$Gini_p$	0.36	0.25	0.04	0.94
$GE2_p$	0.14	0.78	0.0003	10
GDP_{pc}	1.42	1.57	0.023	6.82
Fertility rate	3.61	1.89	1.11	7.27
Life expectancy	6.62	0.94	3.60	7.86
Stage-Dev1	0.11	1.59	−2.99	3.26
Stage-Dev2	0.12	1.83	−3.40	3.45

Table 11
List of the sample countries and cohorts with non missing data.

Country	Number Cohorts
Bangladesh	2
Belgium	7
Brazil	6
Chile	7
China	1
Colombia	6
Czech Republic	1
Denmark	8
Ecuador	6
Egypt	5
Estonia	2
Ethiopia	1
Finland	7
Ghana	6
Hungary	1
Indonesia	3
Ireland	5
Italy	6
Malaysia	5
Nepal	6
Netherlands	7
New Zealand	4
Nicaragua	6
Norway	6
Pakistan	4
Panama	8
Peru	4
Philippines	7
Poland	1
Slovakia	2
Slovenia	1
South Africa	6
Sri Lanka	7
Sweden	7
Switzerland	4
Ukraine	3
United Kingdom	7
United States	8
Vietnam	1
Total	184

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