WORKING MOTHERS AND INTERGENERATIONAL MOBILITY: EVIDENCE FROM SIBLING SCHOOLING GAPS IN VENEZUELA

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MADRES TRABAJADORAS Y LA MOVILIDAD INTERGENERACIONAL: EVIDENCIA A PARTIR DEL LOGRO ESCOLAR DE HERMANOS EN VENEZUELA
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RESUMEN

Este trabajo documenta el cambio en movilidad intergeneracional durante el período de 35 años comprendido entre 1975 y 2010 en Venezuela y encuentra que la igualdad de oportunidades ha incrementado significativamente entre mediados de la década de los setenta hasta alrededor de 1988, momento a partir del cual esta se estancó/revirtió hacia el alza hasta 2004, cuando comienza a mejorar una vez más. La educación pública y el aumento generalizado de la demanda de educación escolar durante el período no son suficientes para explicar estos cambios en la movilidad. Al contrario, el patrón de la participación de la fuerza laboral de mujeres es prácticamente la imagen espejo del índice de movilidad. Un modelo sencillo y sus implicaciones empíricas sugieren que a medida que el tiempo de las madres en los hogares es sustituido por otros factores en la producción de resultados escolares de los niños, las características de las familias (de las madres) son más importantes en los logros de los niños en las escuelas. Estos resultados son consistentes con la literatura que encuentra efectos negativos del cuidado de los niños en logros cognitivos ya que otros insumos son sustitutos imperfectos al tiempo dedicado por los madres a los niños.

Palabras clave: movilidad intergeneracional, educación escolar, América Latina, oferta laboral

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ABSTRACT

This paper documents the change in intergenerational mobility over the 35 year period between 1975 and 2010 in Venezuela and finds that equality of opportunities increased significantly from the mid 1970's until around 1988, then stagnated/reverted slightly up to 2004, when it again began to improve. Publicly provided education and the generalized increase in the demand for schooling throughout the period is insufficient to explain such changes in measured mobility. Instead, the pattern of female labor force participation is nearly the mirror image of the mobility index. A simple model and its empirical implications suggest that as mothers' time at home is substituted by other factors in the production of children's educational outcomes, family (mother's) characteristics become more important in child school achievement; this is consistent with a literature that finds negative effects of childcare on cognitive achievement, as other inputs are imperfect substitutes for mothers' time with the child.

Keywords: intergenerational mobility, schooling, Latin America, labor supply

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Working Mothers and Intergenerational Mobility: Evidence from Sibling Schooling Gaps in Venezuela[*]

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Comments Welcome

Abstract

This paper documents the change in intergenerational mobility over the 35 year period between 1975 and 2010 in Venezuela and finds that equality of opportunities increased significantly from the mid 1970's until around 1988, then stagnated/reverted slightly up to 2004, when it again began to improve. Publicly provided education and the generalized increase in the demand for schooling throughout the period is insufficient to explain such changes in measured mobility. Instead, the pattern of female labor force participation is nearly the mirror image of the mobility index. A simple model and its empirical implications suggest that as mothers' time at home is substituted by other factors in the production of children's educational outcomes, family (mother's) characteristics become more important in child school achievement; this is consistent with a literature that finds negative effects of childcare on cognitive achievement, as other inputs are imperfect substitutes for mothers' time with the child.

JEL Classification Code: J62, I2, J2

Keywords: Intergenerational Mobility, Schooling, Latin America, Labor Supply

1   Introduction

Latin America's dramatic poverty rates and inequality levels go along with bleak social mobility opportunities. Several authors (see Azevedo and Bouillon, 2009; Behrman, Gaviria and Székely, 2001; Behrman, Birdsall and Székely, 2000 and Dahan and Gaviria, 2001) have documented large differences in equality of opportunity between Latin American nations and the United States; the region fails to provide avenues for social advancement to the worse off. The mechanisms through which inequalities are perpetuated over time are of key policy relevance, as governments seek tools and policies that will have lasting effects on the level of inequality and poverty. This paper documents the change in intergenerational mobility over the 35 year period between 1975 and 2010 in Venezuela and examines the possible ways in which shocks may have affected this evolution.

Measuring mobility is hard: On the one hand, correlations between child and parent outcomes can't literally be interpreted as immobility indicators since they could be confused with the effect of an unobserved factor driving both outcomes, and on the other, permanent income or other lifetime status measures for successive generations are difficult to construct. Paes de Barros et al (2009) propose a multidimensional approach to measuring mobility and not only give a discouraging picture of equality of opportunity in the the region, but also highlight the complexity of adequately grasping this key social indicator. Gaviria (2006) shows that perceptions about equality of opportunity can be just as important as mobility itself. This paper does not offer a new measure of mobility, instead, it looks at the long term trends of a popular indicator used by several authors and suggests a plausible driving force behind the observed patterns.

I follow Dahan and Gaviria (2001) in measuring intergenerational mobility as the lack of correlation in schooling achievement among siblings. A high correlation between

siblings' achievement implies that family background plays a significant role in children's outcomes; family background can be taken to mean inherited ability, parental education, income, social status and all other things that co-residing siblings have in common. One advantage of this method is that it does not require estimations of correlations between parents and children, that are subject to potentially important endogeneity issues. Schooling achievement is measured by the individual's schooling gap, which is the difference between the number of completed years of schooling he/she should have at his/her age minus the number of years he/she actually has. For example, since in Venezuela children are supposed to begin the first grade at age 7, a 15- year old child should have 15-7=8 years of schooling; if instead he/she has only 6 years of schooling, then his/her relative schooling gap is (8-6)/8=.25. The use of a schooling achievement indicator suffers from less measurement error than income measures while also providing a proximate measure of lifetime earning capacity. The correlation in sibling schooling gaps is essentially the fraction of schooling gaps that are explained by factors common to them; this is essentially the adjusted R^2 of a regression of schooling gaps on family fixed effects, and possibly gender and age controls. The intergenerational mobility index is $1 - R^2$.

In the mid 1970s in Venezuela, two thirds of an individuals schooling achievement was largely determined at birth by the characteristics of the household the child was born in to, by 1988 this figure had dropped to just over half. Over this period, more room was opened for factors external to the family such as public education, social assistance and economic growth to, along with individual drive, influence his or her schooling achievement. After 1988 and up to about 2004, there is stagnation in mobility prospects, and after that, there appears to be a rapid increase in mobility up to 2010.

Comparisons of this pattern with public expenditures on education and infrastructure, with average nationwide schooling gaps, and with several labor market indicators do not yield any discernible relationship. However, the time plot of female labor force

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participation rates in Venezuela is almost the mirror image of the evolution of mobility, which suggests that families' optimal resource allocation between consumption, market activities and home production (including children's education) shifted mothers' time toward the labor market while at the same time requiring an increased use of other family inputs in the education of children, thereby increasing the importance of family characteristics in explaining individual schooling success. This finding is consistent with a literature showing negative effects of childcare on cognitive achievement of children (Bernal, 2008, Bernal and Keane, 2011), whereby the mother's purchased inputs are imperfect substitutes for her time in the schooling production function.

Faced with large negative income shocks in the second half of the 1980's, mothers were forced to increase their supply of labor to the market, and despite the decrease in household consumption, family investments in education were still large enough to guarantee a continually increasing average level of schooling achievement, so the decline in mobility did not come with an increase in schooling gaps or a slowing of schooling indicators in general, which suggests that on average families compensated for the reduction in mothers' time at home to ensure that children did not fall behind. There are important differences in the weight of family background along the income distribution, and although the highest quintile of the distribution has historically been the most mobile, the difference with the lowest quintile has fallen over time.

The possibility that female labor force participation may have had a significant role in the observed changes in intergenerational immobility, as measured by the weight of family characteristics in children's schooling achievement has not been suggested before and is thus the main contribution of the paper. This potentially important and unexpected consequence of labor market changes should have bearing on the design of policy. In particular, if confirmed by further studies, it would be a strong case for formal childcare provision for working mothers.

2 Measuring Intergenerational Mobility in Latin America

Economic status in the labor market is measured by a person's permanent income, and the degree to which the status attained by an individual depends on that of his or her parents' is a measure of the lack of mobility in the society. Normally, even for developed countries with high quality statistics, there are significant measurement concerns about permanent income, which makes the task of estimating true mobility, difficult; these concerns are even more important in developing nations, where data is often of lower quality; Solon (1999) and Mulligan (1997) provide comprehensive reviews of the issues, theoretical and empirical, although their reference to developing nations is limited. It is useful to illustrate the main estimation problems more precisely. Let y_{ij} be the measured permanent income of person i of family j, and y_j the income of the parent of family j (assume one-parent families for simplicity); we are interested in estimating

$$y_{ij} = \rho y_j + \beta x_j + \varepsilon_{ij} \tag{1}$$

where ρ is the degree to which the child's status depends on that of his/her parent's, x_j is a vector of family characteristics, and ε_{ij} is an idiosyncratic component. Even if measurement of permanent income were not a problem, unobserved characteristics related both to parent's and child's permanent incomes would imply a correlation between y_j and ε_{ij}, rendering the OLS estimate of ρ biased and inconsistent. In addition, since permanent income is measured with error, estimates of ρ will suffer from attenuation bias: the estimated coefficient will be more "attenuated", the larger the variance of the measurement error relative to the variance of the true permanent incomes of the parents.

The significant data requirements for a quality estimation of individual permanent

incomes for several generations over time, make it almost impossible to carry out in most countries. In Latin America, there are almost no sources of data linking an individual's current income with that of his or her parents' income for parent-child pairs not living in the same household. One alternative, which has been explored extensively in the sociological literature on the subject, is to estimate the degree of what may be termed occupational mobility, or to what extent children follow in their parents' footsteps in their choice of occupation[1]. Another route is to estimate the sibling earnings/permanent income correlation. Sibling correlations provide a reasonable measure of the degree to which family influences determine individual economic success, but are incapable, by themselves, of disentangling the influence of parental characteristics, and any other factor common to siblings but not directly related to parental influence. Specifically, express individual income as the sum of a family component ($f_j = \rho y_j + \beta x_j$), shared by all siblings, and an individual-specific idiosyncratic component:

$$y_{ij} = f_j + \varepsilon_{ij} \tag{2}$$

then we may decompose the variance of individual incomes in the population as the sum of the variances of the components:

$$\sigma_y^2 = \sigma_f^2 + \sigma_\varepsilon^2$$

For two-sibling families, the sibling income correlation is

$$corr(y_{1j}, y_{2j}) = \frac{\sigma_f^2}{\sigma_f^2 + \sigma_\varepsilon^2}$$

which is the fraction of the variance in incomes that is explained by the variance of family characteristics. Note that f includes both parental incomes and any other

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[1] See for example Erikson and Goldthorpe (1992) for a review for industrial nations and Gonzalez (2004) for a study on Venezuela.

characteristic (familial or not) shared by siblings.

The restriction to two-sibling families is made only for expositional purposes, and it is clearly not necessary in any empirical implementation. Specifically, Kremer and Maskin (1996), in constructing a labor market segregation index, derive a correlation expression for non-paired observations and show that it is equal to the R^2 of a regression of worker attributes on a set of firm-specific fixed effects. Dahan and Gaviria (2001) and Behrman, Birdsall and Székely (1999) are the first to utilize this approach to estimating the importance of family characteristics in explaining the variance of individual achievement.

Studies on mobility in Latin America have generally relied on household survey data collected as a source of labor market statistics. These data usually do not allow good estimates of individual permanent income and does not contain information on parents-children not living in the same home; for these reasons they have used schooling achievement as a proximate measure of future labor market success, and have constrained the sample to siblings between the ages of 14 and 20[2]. Such is the rationale in Dahan and Gaviria (2001), Behrman, Birdsall and Székely (1999), Behrman, Gaviria and Székely (2001), Bourguignon, Ferreira and Menendez (2003) and Andersen (2000), and is the rationale the present paper follows as well. Since the approach by construction selects high fertility households, if there is a quantity-quality tradeoff, excluded households with lower fertility may have on average higher schooling achievement, however, it is not clear that this would bias the estimation of the weight of family background on individual achievement in one direction or the other. As mentioned before, schooling achievement is measured through the relative schooling gap, which is the difference between the number of years of schooling a child should have for his/her

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[2]Restricting the sample to siblings in this age group makes sense also because there are small or negligible generational differences between siblings of similar ages. Age and gender controls can also be included in the fixed effect regression to obtain mobility measures that are conditional on demographics.

age and the number of years he/she actually has.

In to order place the present discussion in perspective, table 1 reproduces part of the results reported by Dahan and Gaviria (1999) for several Latin American countries and the United States in the mid 1990's[3]; specifically, it shows the estimated fraction of individual schooling gaps that is explained by family characteristics (see the appendix for the exact formulae) and the average relative schooling gap.

El Salvador appears to be the country with the lowest degree of intergenerational mobility, followed by Paraguay, Brazil and Nicaragua. At the other extreme are Chile and Venezuela, with the highest measured levels of mobility. One of the key elements that has been underscored in this literature is the negative correlation between schooling gaps and measured mobility: in this sample, Chile has the lowest schooling gap and the highest measured mobility, while El Salvador has just the opposite. The correlation of the 12 mobility and schooling gap observations shown in the table is $-.78$. The value for the US suggests that family characteristics do not play a major role in explaining schooling gaps there, and suggests that the differences in the degree of mobility in Latin America and advanced economies can be staggering.

3   Venezuela: 1975 - 2010

Using data from Venezuela's biannual household surveys[4], I construct the mobility index as $1 - \rho_a$ where ρ_a is the adjusted R^2 from a regression of sibling (between 14 and 20 years of age) schooling gaps on family fixed effects biannually from 1975 up to 2010. Figure 1 shows the evolution of ρ_a over time. The reported figures are comparable with those presented in table 1 for other Latin American countries.

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[3]I exclude their estimates for urban populations only as there appear to be systematic differences between urban mobility measures and rural measures.

[4]The Venezuelan statistical agency, Instituto Nacional de Estadísticas (INE) runs its household survey (Encuesta de Hogares por Muestreo) throughout the year, excluding the first and last 2 weeks of the year. It makes the raw data available twice a year for representativeness of the sample at the state-level.

The figure shows the fraction of schooling gaps that is explained by factors common to siblings residing in the same household. This restriction is not troublesome given the age group under consideration (in 2002, only 1.1% of the heads of households in Venezuela were aged between 14 and 20, which suggests that we are not missing a large group of the population within this age group by considering only those who still live with their parents). The next figure shows the same fraction, but once the correlation has been controlled by age and gender; that is, it shows the same adjusted R^2 (ρ_a) but after including age and gender controls in the family fixed effects equation.

These two figures illustrate the key finding of this paper regarding intergenerational mobility in Venezuela. They both show a clear downward trend in the importance of family characteristics in explaining individual schooling gaps up until the late 1980's. From then onwards this trend either stagnated or reversed (depending on whether one considers the conditional or unconditional correlations) up to 2004, and then resumed a downward trend up to 2010.

When considering unconditional correlations, we see that familial factors explained approximately 60% of the individual's schooling gap around 1975 and only 45% in 1988, this steady flexibilization of society's distribution essentially stopped at that point and even reversed itself partially all the way up to 2004, when it began to decrease again. Conditional correlations (on age and gender) show an even starker picture: family characteristics went from representing almost 70% of schooling gaps to around 50% in 1988 and then back up to 61% in 2004 and 48% in 2010. Within the limitations of this measure of intergenerational mobility, which cannot distinguish between factors related to parents and any other that siblings may have in common (such as neighborhood, school quality, etc.), these changes in measured equality of opportunity are quite significant. Figure 3 plots the actual mobility index, which is $1 - \rho_a$ and which shows exactly the patterns just described.

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3.1 Unequal Mobility

A natural question is whether measured mobility differs in a significant way along the distribution of income. If the observed average patterns are mainly driven by more pronounced changes in one segment of the distribution of income alone, the policy implications may be different. Table 2 shows the average mobility index over the entire period by quintile of the distribution of per capita family income.

The table shows that on average, over the last 35 years, mobility has been relatively uniform over the distribution of income, except at the bottom end, where mobility has been significantly lower. Notice that low mobility at the bottom of the distribution is indicative of low upward mobility, since those at the bottom have more room to move up than down. This is the real tragedy of poverty and inequality in Venezuela, and possibly other countries in the region: a person born in a poor household not only faces the discomfort of deprivation and the frustration of feeling short changed, he or she must face up to the fact that in all likelihood he or she will live that way all her life.

Figure 4 shows the evolution over time of the mobility index for the first and fifth quintiles as well as the index for the whole population. The pattern described in table 2 is generally confirmed: the poor have fewer mobility opportunities than the better off. However, over time the magnitude of this gap has fluctuated significantly: it dropped sharply between the mid 1970's and the early 1980's, then it rose again up to the early 90's and then fell until around 1999 when it began its current upward trend.

These fluctuations over time are significantly reduced once age and gender controls are included in the construction of the index, which is evident from figure 5. There does appear to be a trend towards a reduction in the differences in intergenerational mobility between individuals at the top and those at the bottom of the distribution. Figure 5 also highlights another relevant fact. The upward trend in mobility from the mid 1970's and subsequent reversal in the late 1980's, identified for average income

levels, is roughly replicated at both ends of the distribution, although with much more variability between years both for the top and the bottom quintiles.

The most relevant point is the fact that from the mid 1970's, up until the late 1980's, Venezuela was gradually improving social mobility opportunities for everyone: upwards for those at the bottom and also downwards for those at the top. This changed around 1988, and since then, opportunities for social mobility became increasingly more difficult for the entire population, a trend reversed only after 2004.

4 A Simple Theoretical Framework

Like other studies on mobility in Latin America, this article's focus on schooling as a predictor of labor market success points to explaining any observed pattern in mobility with changes in the provision of public schooling or changes in the overall level of schooling in the population due to better access to markets, demand factors, or other elements associated with educational attainment of the population in general.

Recall that mobility is being measured as the lack of correlation between sibling schooling gaps; if family characteristics lose importance in explaining individual schooling then the society is said to be more mobile. Let S be the schooling attainment of a child, then we may generally write it as

$$S = f(t_m, t_f, t_r, x, P; S_m, S_f, S_r) \tag{3}$$

where t_i is the amount of time family member i spends with the child (m = mother, f = father, r = relative), x is a privately purchased input (or inputs), P is a publicly provided input and S_i is the schooling of family member i. In making their human capital investments, bequests and current consumption decisions, families face a two-stage problem: they must decide on the level of each of the variables in their utility

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function, and they must choose the combination of inputs that minimizes the cost of the home-produced goods (such as children's education). The function (3) represents the technological constraint facing the family when choosing a given level of schooling for its children, the cost of which it wishes to minimize.

Once the optimal choices of inputs are made (parents' time, purchased inputs, etc.), we can establish a correspondence between the schooling representation in (2) and that in (3). So far we've seen that factors common to siblings (family characteristics) lost importance in explaining individual schooling from the mid 70's up until around 1988, regained importance continually up to 2004 and then decreased again up to the end of the sample. Notice that this does not necessarily have anything to do with the level of schooling attained by the population, it merely refers to the relative importance that the different kinds of factors have had in explaining the observed level.

It is worth emphasizing that throughout the study period, as in all of Latin America, formal schooling increased significantly in Venezuela: the average schooling level of the workforce went from around 4 years to over 8 between 1975 and 2003. This is also reflected in measured schooling gaps over this period, shown in figure 6, which went from 36% in 1975 to 16.3% in 2003 and XX in 2010. It is clear from the figure, however, that there have not been changes in the trend of schooling gaps over the study period, in contrast to what we observe for the mobility index.

This trend suggests that over this period, whatever factors have led the population to choose higher levels of formal schooling, have remained very important over time, and the observed changes in mobility have not been a consequence of families choosing different levels of schooling. Instead, it appears that the optimal combination of inputs in the production of children's education has changed over time.

4.1 Public Spending on Education

Public spending on education services can provide a substitute for family inputs in the education process (both purchased inputs as well as parents' time). Families may choose to send their child to a public school and allocate the extra cash to some other use if they feel their child will obtain essentially the same product. Several studies have estimated schooling production functions (See, among others, Figlio, 1999, Hanushek, 1986, Gyimah-Brempong and Gyapong, 1992 and Jimenez, 1986) normally with the objective of estimating the productivity of the various publicly provided inputs used in formal education, but also for obtaining estimates of the degree of substitutability between factors. Although with some mixed results, this literature has found that public inputs to schooling have a positive but quantitatively small effect on schooling outcomes and that there is a relatively small degree of substitutability between inputs such as the teacher/pupil ratio and teacher quality as measured by salaries. None of these studies, however, have estimated the degree of substitutability between public and privately provided inputs in the production education. The estimated positive productivity of public spending on education (see Figlio, 1999) is a necessary condition for positive substitutability between public and private inputs, although its small magnitude suggests that this degree may be rather small as well. Dahan and Gaviria (2001) and Behrman, Gaviria and Székely (2001) have suggested, based on observation of cross-national evidence, that the size of the public sector's effort is important for explaining international differences in measured mobility. They do not, however, attempt to estimate the substitution elasticities. Figure 7 shows real public expenditures on education in Venezuela between 1975 and 2003. Another interesting fact is that beginning in 1997, and through 2009, budgeted real public expenditures in education increased dramatically, increasing by approximately 43% in the last 10 years alone.

The correlation between the mobility index and real educational expenditures (up to

2003) is $-.105^5$, and although obviously not evidence of a negative causal relationship, it does question the extent to which it is likely to find a very significant effect of public schooling expenditures on intergenerational mobility. This does not mean that publicly provided inputs are not important for schooling achievement, it merely means that they do not appear to be the driving force in first reducing and then increasing the importance of familial inputs, indicating they have not served as substitutes for inputs provided in the household.

4.2   Female Labor Force Participation and Household Inputs

Many studies have documented the importance of parental education on children's educational attainment, specially that of the mother (see Haveman and Wolfe, 1995). Figure 8 shows the female labor force participation rate for the period studied for the families included in the estimation (those with at least two children between the ages of 14 and 20). The trends closely resemble that of the female participation rate for the whole population of working age; they also coincide very closely with the changes in the trend of the mobility index observed around 1988, and 2004, which suggests that the increase in the importance of family characteristics is related to the substitution of the mother's time at home for other family-provided inputs. If mother's time at home is more productive in the production of good schooling outcomes for children than other factors on average, then reducing the use of the mother input requires a disproportionate increase in other family-specific factors such as nannies, extra-curricular activities or other purchased inputs, increasing the importance of family characteristics in explaining children's schooling outcomes.

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[5]The distribution of public spending between different schooling inputs: teachers, materials, infrastructure, etc. could make a difference in the efficacy of public spending as a substitute for privately provided inputs. In Venezuela, although the distribution of this spending has changed significantly over time, the correlation of the mobility index with personnel expenditures is $-.148$ and with expenditures on supplies, it is $-.275$; therefore, the subsequent analysis is unaltered when considering more disaggregated measures of public spending on education.

Figure 9 shows the female labor force participation rate for different groups of mothers in the sample: mothers with some help at home, mothers with a child under 7 years of age, and mothers with an unemployed husband/partner. There are few differences in the trends followed by these participation rates, which suggests limited substitution of mothers' time at work for other family members' time at home but instead with whatever goods and services are purchased in the market with the additional money they bring to the household.

Increased female labor force participation not only has the implication that mothers spend less time at home; which reduces their contribution to the production of children's schooling, it also implies that they are generating more income, which has a positive impact on children's schooling. The net effect will depend on the elasticity of substitution between mother's time at home and money in the schooling production function. The size of the increase in mother's income depends on her schooling: women with more years of formal education will on average contribute more to family income than those with less schooling, the implication of this in terms of measured mobility is that the importance of family characteristics (one of which is mother's schooling) on children's achievement increases with the increase in female labor force participation. Notice, however, that for this to be true it is necessary that there be less dispersion in the productivity of mother's time at home than in the labor market. To illustrate the point, consider two stay-at-home moms, one of which has completed primary school alone while the other has also finished high school; the more schooled mother makes a larger contribution to her children's schooling than the less schooled mother makes to hers, call this difference Δ_h; imagine that both of these women now decide to work, the more schooled mother will earn a higher salary and therefore make a larger contribution to her children's schooling than that which the less schooled mother makes, call this difference Δ_l. If the difference in productivity in the labor market is greater than the difference in productivity at home ($\Delta_l > \Delta_h$), then the same schooling difference

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(primary vs. household) will be more important in explaining the difference in their children's attainment when they are both working than when they are not.

More precisely, consider a quasilinear version of the production function (3):

$$S_{ij} = (g(S_{mj})t_{mj} + h(S_{mj})(1 - t_{mj})) + \omega_j + \varepsilon_{ij}$$

where now ω_j includes all family characteristics other than mother's schooling (S_{mj}) or the fraction of her time that is dedicated to home production (t_{mj}), and where the functions $g(\cdot)$ and $h(\cdot)$ are increasing in mother's schooling[6]. Assume for simplicity that all mothers choose the same allocation of their time between home and market production[7], so the variance of S_{ij} is

$$\sigma_S^2 = t_m \sigma_g^2 + (1 - t_m)\sigma_h^2 + t_m(1 - t_m)cov(g, h) + \sigma_\omega^2 + \sigma_\varepsilon^2$$

If we assume for simplicity that the covariance term is zero (which would mean that skills at home are very different than skills in the labor market), the importance of family characteristics will increase with a reduction in t_m $(\partial \sigma_f^2/\partial t_m < 0)$ only if $\sigma_h^2 > \sigma_g^2$, so the variance in market productivity must be higher than the variance of home productivity[8].

Lacking estimates of the productivity of mother's schooling in home-production, it is possible to approximate a measure of its dispersion with the dispersion of schooling levels, under the assumption that $g(\cdot)$ is linear. Market productivity can be approxi-

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[6]In an important paper, Behrman, Foster Rosenzweig and Vashishtha (1999) estimate a positive home-productivity effect $(g' > 0)$ of female schooling using data from Indian rural households. They show that ignoring this effect leads to gross underestimation of the social returns to female schooling.

[7]It is possible to extend this framework to allow for heterogeneity in the allocation of time between mothers with different levels of schooling. The resulting intuition is the same as that presented here, but the algebra is more cumbersome.

[8]If $g(S_{mj}) = \alpha S_{mj}$, $h(S_{mj}) = \beta \exp(\gamma S_{mj})$ and the distribution of mother's schooling were distributed $N \sim (\mu_{S_m}, \sigma_{S_m}^2)$, the condition that $\sigma_h^2 > \sigma_g^2$ would become $\beta^2 \left[\exp(2\mu_{S_m} + \sigma_{S_m}^2)(\exp(\sigma_{S_m}^2) - 1)\right] > \alpha^2 \sigma_{S_m}^2$.

mated with wages, which also depend on schooling, possibly in a way similar to that described in footnote 7. The coefficient of variation of schooling for the sample of mothers of households with at least two children between the ages of 14 and 20 in 1975 was 1,63% and the coefficient of variation of their wages was 4,25%. In 2003, these numbers were 1,02% and 3,17% respectively. These values are consistent with the theoretical prediction that increased labor market participation of mothers should increase the weight that family factors play in determining children's schooling achievement. Allowing time allocation to vary with the level of education yields similar results. This result is consistent with the result found for developed countries (Bernal, 2007 and Bernal and Keane, 2011) that childcare decreases cognitive achievement, as it suggests that other inputs are generally imperfect substitutes of mother's time in the education production function. Lopez and Ribero (2005) provide some evidence that such imperfect substitution is identifiable in Colombia.

5   Concluding Remarks

This paper has documented a significant increase in intergenerational mobility between 1975 and 1988 and a subsequent decline up to 2004 and a further increase from then onwards in Venezuela. This occurred while the average level of schooling increased steadily throughout the period, which suggests that the observed trend was not a consequence of a change in families' choices regarding children's schooling achievement. It also occurred while public spending on education fluctuated significantly over time with no apparent relation to observed mobility.

The clear shift in the trend of measured mobility closely matches the change in the trend of female labor force participation: in the late 1980's, female participation in the labor market increased steadily until 2004 and has declined slightly since then. It is argued that increased female labor force participation has led to a fall in mobility

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because labor market participation exacerbates the differences in productivity between women in the production of schooling for their children, possibly arising from their differing levels of formal schooling. The fact that we don't necessarily observe concomitant changes in childcare by other family members may have to do with our focus on children between 14 and 20 years of age, who require less intensive supervision, and suggests that for this age group mother's time is substituted with purchased inputs.

Although this paper presents a simple framework under which the observed trends in intergenerational mobility can be explained by changes in female labor force participation, it has not attempted to quantify the fraction of the changes in mobility that may be due to women being more active in the labor market. A simple analysis of variance suggests that female labor force participation explains 41.7% of the observed variation in mobility over the period, but these are endogenous variables, so it is difficult give credibility to such a figure. A more promising route for future research would be to obtain estimates of the substitution between parental time and other inputs in the production function of education and other outcomes such as health (see Attanasio and Vera-Hernandez, 2009 for the case of nutrition in Colombia). This paper shows that such estimated impacts at the micro level are likely to be large and widespread enough to appear in aggregate indicators, which may highlight the first-order importance of policies geared to providing adequate, high quality childcare support for mothers who choose to participate in the labor market.

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7 Appendix

7.1 The correlation coefficient with more than 2 siblings

The R^2 of a regression of individual schooling gaps on family fixed effects is

$$R^2 = \frac{\left(\sum_{i=1}^{F} \sum_{j=1}^{S_i} (y_{ij} - \overline{y})^2 \sum_{k=1}^{S_i} (y_{ik} - \overline{y})^2 \right) / S_i}{\sum_{i=1}^{F} \sum_{j=1}^{S_i} (y_{ij} - \overline{y})^2}$$

where F is the number of families in the sample, S_i is the number of siblings in family i and S is the number of children in the sample. This number will be positive even if schooling gaps are assigned in a purely random fashion among children, so it is necessary to adjust this number so that it will capture any correlation above that which would be expected from purely random assignment. The adjusted R^2 gives the desired magnitude:

$$\rho_a = 1 - (1 - R^2) \frac{S-1}{S-F}$$

which is the number that is reported in the text as the fraction of the schooling gap explained by family characteristics.

Table 1: Fraction of schooling gaps explained by family characteristics in LA

	Year	Fraction	Schooling Gap
El Salvador	1995	.722	.422
Paraguay	1995	.670	.354
Brasil	1995	.668	.482
Nicaragua	1993	.661	.527
Honduras	1996	.622	.439
Ecuador	1995	.607	.276
Mexico	1996	.573	.263
Peru	1996	.562	.216
Panama	1995	.547	.237
Costa Rica	1995	.524	.331
Venezuela	1995	.496	.261
Chile	1994	.467	.177
Average		.561	.293
USA	1996	$-.134$	.226

Note: Excerpt from Table 1 in Dahan and Gaviria (1999). All samples are restricted to siblings between 14 and 20 years of age. Column 3 shows the adjusted R^2 of a regression on individual schooling gaps on a family dummy, as described in the appendix and denoted ρ_a. Column 4 shows the average relative schooling gap in each country, where the schooling gap is the difference of the number of years of schooling that a person should have according to his/her age and the years of schooling he/she actually has.

Table 2: Mobility Index by quintile of the per capita family income distribution. Average over 1975-2003

	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5
Average Index	.390	.429	.452	.456	.456

Note: The mobility index is constructed as $1 - \rho_a$, where ρ_a is the adjusted R^2 of a regression of schooling gaps on a set of family fixed effects. Quintiles are defined over the distribution of family per capita income for each semester, the reported figure in the average of the mobility index over the entire period from 1975 to 2003.

Figure 1: Contribution of family characteristics to schooling gaps of children between 14 and 20 years of age in Venezuela.
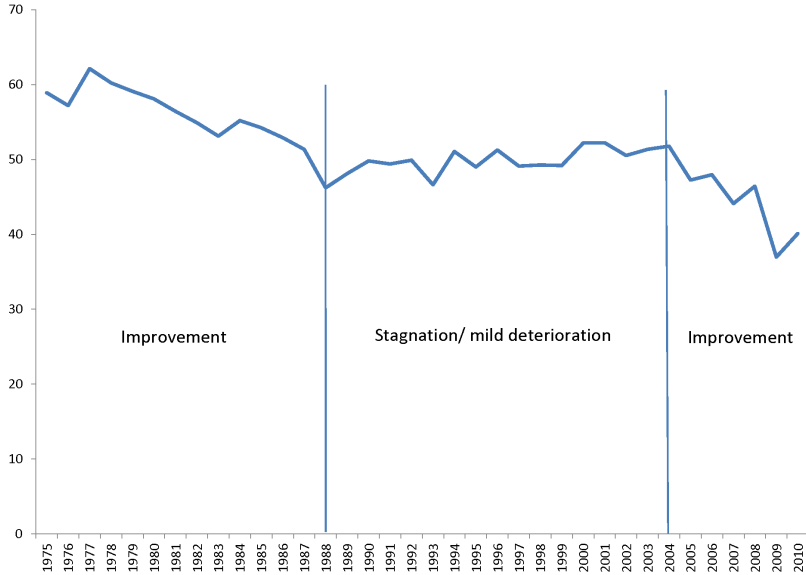
Figure 2: Contribution of family characteristics to schooling gaps of children between 14 and 20 years of age in Venezuela. Conditional on age and gender.
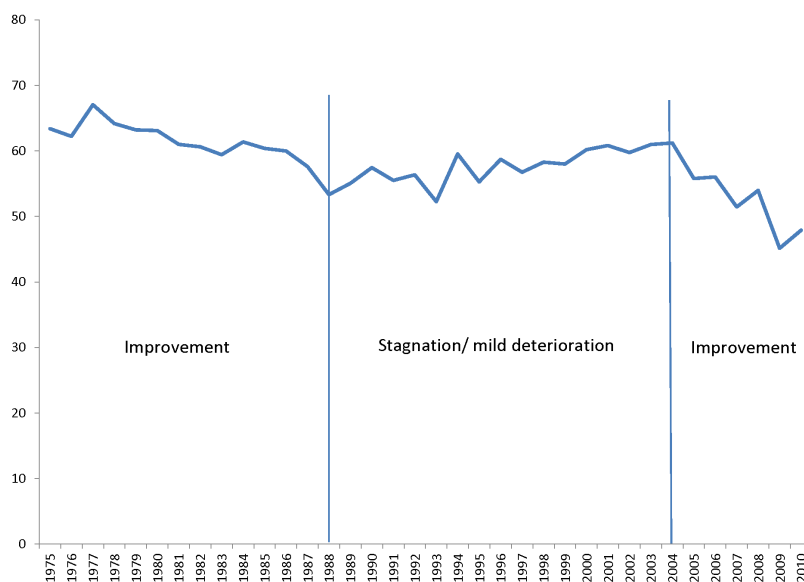
Figure 3: Intergenerational Mobility Index: Fraction of schooling gap that is explained by factors unrelated to family background.
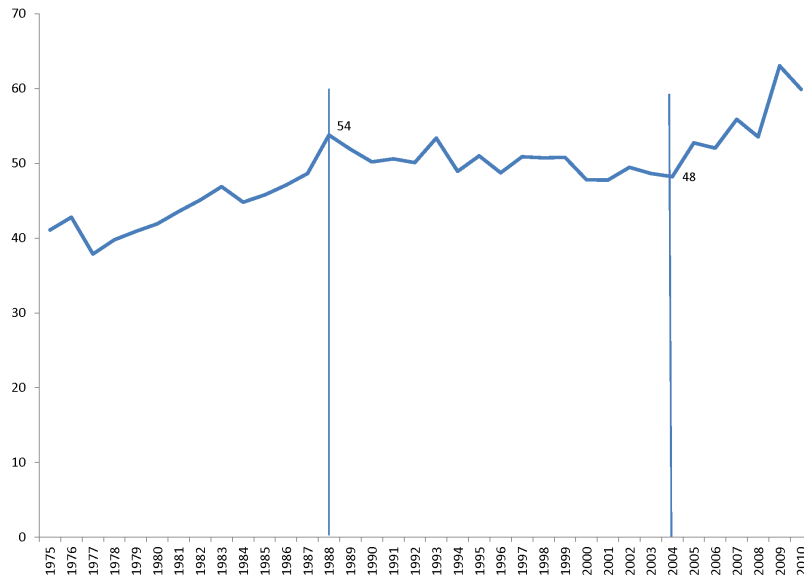

Figure 4: Intergenerational Mobility Index for the top and bottom quintiles of the distribution of per capita family income.
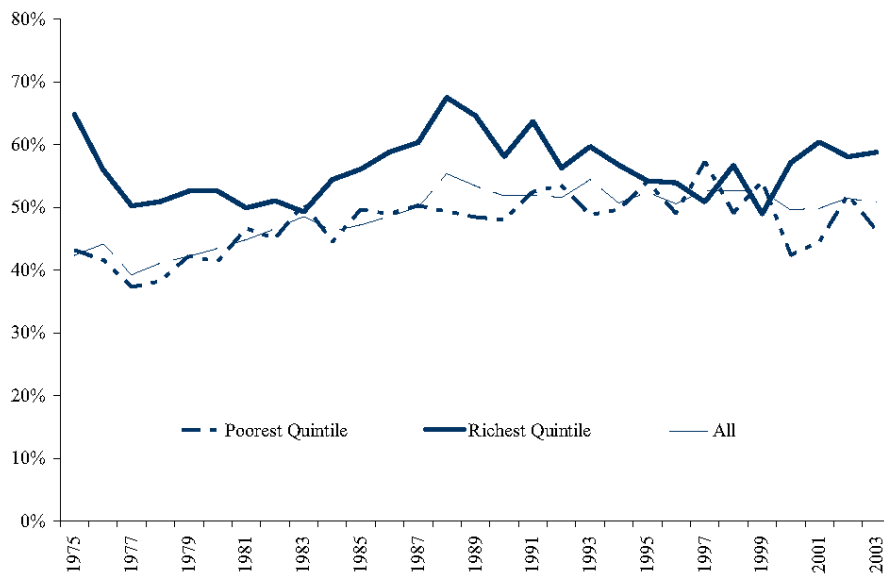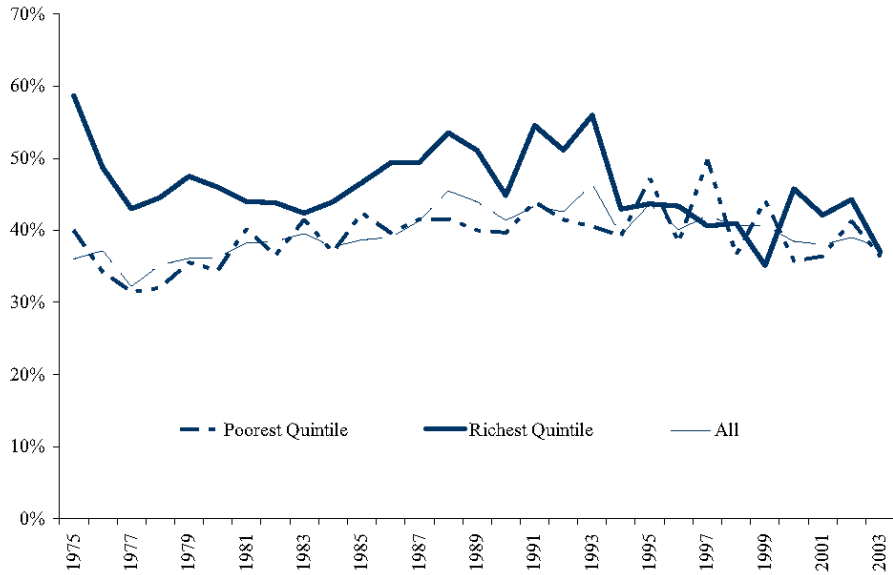
Figure 5: Intergenerational Mobility Index for the top and bottom quintiles of the distribution of per capita family income, conditional on age and gender.

Figure 6: Average Schooling gap of the population between 14 and 20 years of age in Venezuela.
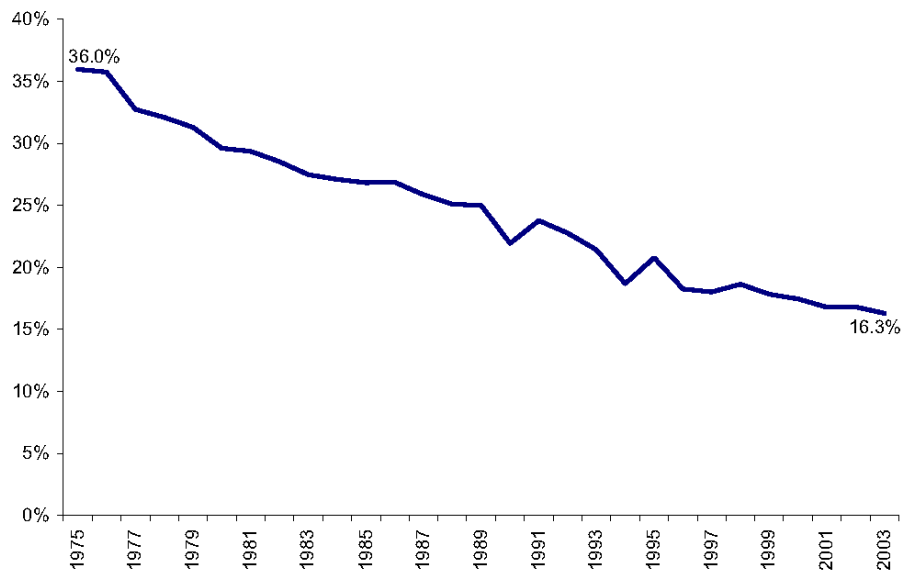
Figure 7: Budgeted expenditures of the Ministry of Education and the Ministry of Higher Education (2003 only) measured in constant 1997 Bolivars. Source: National Budget Law, Ministry of Finance, several years.
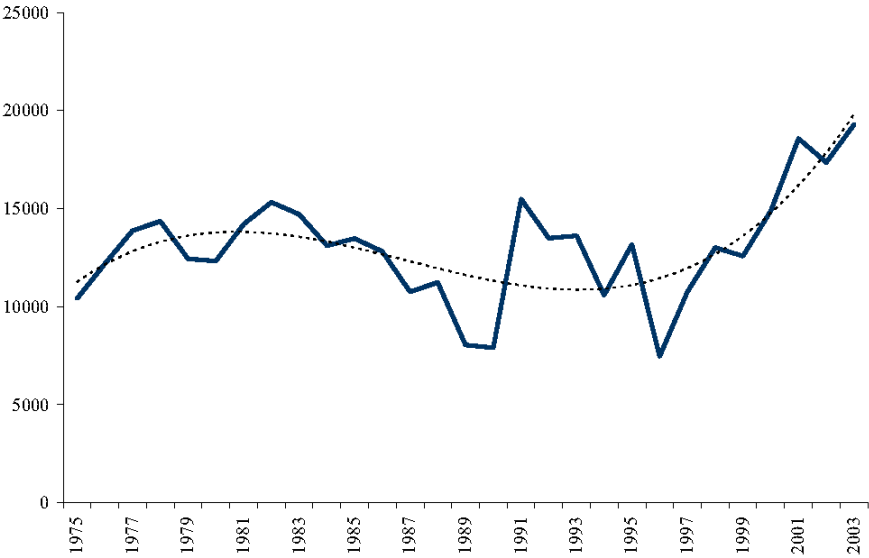
Figure 8: Labor force participation of mothers (or maternal figures) in households with at least 2 siblings of ages between 14 and 20.
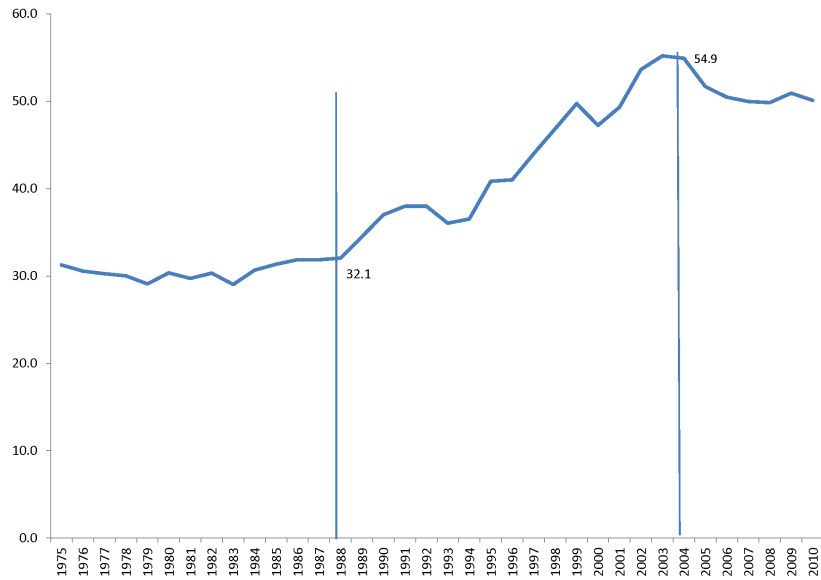

Figure 9: Labor force participation rates for mothers of households with at least 2 children between 14 and 20 by groups.