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Income mobility in Ecuador

New evidence from individual income tax returns

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Abstract: This paper presents new evidence on the study of income mobility in Ecuador over the period 2004–11. We utilize longitudinal data of individual income tax returns to measure income mobility both at the top and at the middle of the income distribution, and we find three main empirical results. First, income mobility in Ecuador is low for top incomes: the probability of remaining in the top 1 per cent after one year is nearly 66 per cent, and it remains stable by the end of the period. Second, there is a high degree of mobility for the rest of the income distribution. Individuals are more likely to experience upward mobility than downward mobility, especially those in the middle income deciles. Third, regression results suggest that the initial position in the income distribution is highly related to the probability of upward or downward mobility. Moreover, having a high-school degree is associated with upward income movements. To our knowledge, this is the first time that research uses data from tax returns to measure income mobility in this South American economy.

Keywords: Income mobility, income inequality, top incomes, middle class, Latin America
JELL classification: D31, H24, N36, and O54

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1 Introduction

While many studies have recently documented the decline in income inequality in most Latin American countries since the 2000s, (Cornia 2014; Lustig et al. 2013; Gasparini et al. 2009), less attention has been paid to the study of income mobility in this region. This paper investigates intragenerational income mobility in Ecuador with a focus on the top and middle of the distribution. First, we study whether the evolution of top income shares has been accompanied by an increase or a decrease in mobility for high-income groups. Second, we analyse whether a surging Ecuadorian middle class has arisen. Our study is based on individual income tax returns from 2004 to 2011.

We have two main motivations for this study. The first is based on the growing interest in the study of top shares of income using income tax data and national accounts. Since the seminal work of Piketty (2001) and Piketty and Saez (2003) on the long-run distribution of top incomes in France and in the United States, the evolution of income concentration in different countries has received much attention both in research and in politics. Several researchers have used tax return statistics to study the historical evolution of top income shares in more than 25 countries. All of these studies have been published in two collective books (Atkinson and Piketty 2007, 2010), and many of the series are available at the World Top Incomes Database (WTID).[1] Some studies belonging to this growing literature have also analysed income mobility at the top of the income distribution. For instance Saez and Veall (2005) for Canada, Landais (2009) for France, Björklund et al. (2012) for Sweden, Jenderny (2013) for Germany and Fairfield and Jorratt (2014) for Chile.

In a recent work (Cano 2014), we followed the top incomes literature, and by employing individual income tax returns data and external controls for income and population, we computed series on top shares of income for Ecuador from 2004 to 2011. Our results suggest that the top 1 per cent of income earners received almost 20 per cent of total income in 2011, similar to findings for other Latin American countries for which estimates are available.[2] Although income concentration remains extremely high at the top of the distribution, our top income series have decreased since 2009.[3] We have not, however, explicitly analysed income mobility, and understanding how income evolves over time is a key factor in the study of income inequality.

The second motivation is based on the study of intragenerational mobility, especially on the study of Latin America's growing middle class. A recent economic report from the World Bank (Ferreira et al. 2013) has documented the expansion of the middle class in this region by approximately 50 per cent over the last decade. The change in the size and the composition of this social class must imply a reduction of income inequality in some way. It is an important issue because we know that in the long run the decrease of middle incomes is a source of stagnation and economic crisis (Piketty 2013).

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[1] Series of top income shares are available online at the Paris School of Economics at http://g-mond.parisschoolofeconomics.eu/topincomes/ and include estimations for developed countries, and for some developing countries such as China (Piketty and Qian 2009), India (Banerjee and Piketty 2005), Indonesia (Leigh 2007), Argentina (Alvaredo 2010), Colombia (Alvaredo and Londoño 2013), and Uruguay (Burdín et al. 2014).

[2] In 2011, the income accruing to the top 1 per cent group was almost 20 per cent when using external controls for total income and population based on surveys (approximately 40 per cent of GDP), and between 12 per cent and 15 per cent when using a control total for income based on national accounts (approximately 65 per cent of GDP) and different definitions of income at the numerator of the share.

[3] This pattern is consistent with recent empirical evidence based on household surveys suggesting a decline of income inequality in most Latin American countries since the 2000s.

In Ecuador, estimates of economic mobility for the middle class are unfortunately scarce mainly because of a lack of appropriate data that look at how the income of individuals changes over time. This paper contributes to this discussion by measuring income mobility in Ecuador over a seven-year period. We organize our analysis into three parts. In the first part, we explore income mobility between the richest 1 per cent, 0.1 per cent, and 0.01 per cent. For this, we construct Ecuadorian top income shares using individual income tax returns to compute top income series, and external controls to compute aggregate income. Afterwards we compute the probability of remaining in the top income groups after one, two, or three years. Then, using transition matrices we study movements into and out of the top income groups.

In the second part, we analyse income mobility between the middle income deciles. To do this, we construct transition matrices, and we analyse movements and staying probabilities of the entire tax-filing population. Certainly there are limitations when utilizing the tax database, especially for the bottom of the income distribution, but as we will see in Section 3, the tax database provides an accurate measure of income for middle- and high-income individuals. In the third part, we analyse the factors associated with income mobility over the 2008–11 period. We estimate transition probabilities of upward or downward mobility while controlling for variables associated with mobility, such as the initial income position, age, gender, level of education, marital status, and geographical region of origin.

To our knowledge, this is the first time that research uses individual income tax returns data to compute income mobility in Ecuador. The rest of the paper is organized as follows. Section 2 presents the literature review and develops hypotheses. Section 3 describes the data and the methodology. Section 4 presents the main findings of top income mobility. Section 5 presents the findings of income mobility and the results of our regression analysis. Section 6 offers conclusions. All tables concerning income mobility are presented in the appendices.

2 Income mobility: A literature review

Mobility is a concept that has been analysed largely in different branches of social sciences such as economics or sociology. In this paper, we focus on the economics literature that assesses the role of mobility in the study of income distribution.

What is income mobility and how does it vary from income inequality? Most studies on income inequality provide 'snapshots' of the income distribution at one specific point in time (Fields and Ok 1999). Unfortunately, 'snapshots' or static positions are unable to depict the dynamics of income over time, and therefore the opportunity for individuals to move up or down through the income distribution (Auten and Gee 2009). With the aim of studying income dynamics, a large body of the economics literature analyses changes in economic status from one period of time to another, or from one generation to another. An important review of conceptual and methodological issues of income mobility is provided in Fields (2000), Fields et al. (2001), Burkhauser and Couch (2011), and Jäntti and Jenkins (2013).

Nevertheless, because the term 'mobility' connotes different ideas to different researchers, the literature on income mobility is vast and does not provide a harmonized framework of analysis (Fields et al. 2001). We will start this section by stressing the main income mobility definitions, and then we present the specific mobility measures that will be used in the remainder of this paper.

2.1 Main income mobility definitions

Although income mobility is certainly less clearly defined by the economics literature than income inequality, a prime definition that drives most mobility analysis concerns *the changes in economic status of individuals from one period of time to another*. Based on this definition, in this paper we make three principal mobility distinctions.

The first distinction concerns two mobility magnitudes. The first is intragenerational mobility, which analyses income dynamics of the same unit of observation (individuals or households) over time. The second one is intergenerational mobility which focuses on income dynamics across generations (parents and children) in different periods of time. For instance, most studies on mobility between generations are associated with the notion of equality of opportunity.[4]

The second distinction refers to ways to measure mobility. The existing literature proposes more than 20 empirical mobility measures, which are mostly associated with different mobility definitions and with particular aspects of mobility that one seeks to capture (Fields 2010; Ferreira et al. 2013). Following the seminal work of Fields (2000), we identified three fundamental *mobility measures* as follows: (i) mobility as time-independent, (ii) mobility as movement, and (iii) mobility as an equalizer of long-term incomes.

(i) Mobility as time-independent answers the question about dependence between present and past income: is the initial position less or more determinantal to a future position? This approach can be seen as the correlation between the initial and the final income vectors over a period of time (Ferreira et al. 2013). This approach is also employed by the intergenerational literature. Indeed, the intergenerational income mobility is usually estimated by a linear regression model in which the logarithm of the child's income is regressed on the logarithm of the parents' income (Solon 2002). The regression coefficient β is therefore interpreted as the intergenerational income elasticity.

(ii) Mobility as movement is the second category of income measurement. Following the influential taxonomy of Fields (2000) and Ferreira et al. (2013), we identify four basic sub-concepts as follows:

- **Positional movement** seeks to measure the movement of individuals across different positions (quintiles, deciles, percentiles, or ranks) in the income distribution.
- **Share movement** seeks to quantify the movement (rise or fall) of individuals' income relative to the mean. Individuals can register upward or downward movement, although their income remains unchanged (Fields 2008).
- **Non-directional income movement**, also called income flux, seeks to measure the amplitude of income fluctuations.
- **Directional income movement** seeks to quantify the extent of net upward or downward movement in individual incomes.

(iii) Mobility as equalizer of long-term incomes seeks to measure whether changes in income at one point in time influences income inequality over the long term.

[4] Naturally, inequality of opportunity involves different dimensions, and it can be measured in a number of different ways. See for instance Rawls (1971), Nozick (1974), Sen (1980), Dworkin (1981), and Roemer (1998). Moreover, Barros et al. (2009) and Brunori et al. (2013) offer an excellent review of the concepts and approaches to the measurement of inequality of opportunity.

The third distinction is based on the concept of *relative* and *absolute* mobility (Fields and Ok 1999; Fields 2008). Auten and Gee (2009) define relative mobility as the changes in individuals' income over time relative to the income of other individuals, and absolute mobility as the changes of individuals' real income over time. Moreover, Brunetti and Fiaschi (2013) suggest that relative mobility depends not only on the relative variations of individuals, but also on how social conditions have changed with respect to the average of the income distribution.

For the purpose of this paper, we will focus on income mobility defined as the changes in economic status from one period of time to another (mobility as time-independence and mobility as movement) in an intragenerational dimension. The next subsection reviews the literature on top income mobility and on middle-class mobility and presents hypotheses to be tested.

2.2 Literature on top income mobility and hypothesis

Though research on top income mobility is scarce,[5] there is increasing evidence from top incomes literature suggesting that the rise in income concentration has not been accompanied by an increase in income mobility at the very top. Moreover, staying probabilities in top income groups remain stable over time.

Starting on the intragenerational dimension, Auten and Gee (2009) analysed income mobility in the United States at the top of the distribution utilizing a large set of data from income tax returns, over the period 1987–2005. The authors found that nearly 40 per cent of individuals in the top 1 per cent in 1996 remained in the top 1 per cent by 2005, whereas more than half of individuals in different income quintiles have moved to other ones over the same period of time. In a recent version of their work, Auten et al. (2013) analysed the persistence rates of top incomes for the period 2000–10. The authors found nearly the same trend. Between 41 and 49 per cent of high-income earners, who started in the top 1 per cent at the beginning of the period, were also there five years later.

Furthermore, Kopczuk et al. (2010) using social security administration longitudinal data since 1937, demonstrated that the increase in income concentration in the United States had not been accompanied by an increase in income mobility at the top of the distribution. The probability of remaining in the top 1 per cent of the distribution after one, three, or five years is nearly 60 per cent and it has remained stable since 1978. On the intergenerational level, Chetty et al. (2014b) analysed income mobility in the United States between 1996 and 2012. By employing information from federal income tax records, the authors calculated two different measures of mobility based on relative and absolute mobility concepts. On the one hand, the results suggested that intergenerational mobility in the USA has remained constant over the last 20 years. On the other hand, the study found that the probability of a child born in the bottom quintile reaching the top quintile as an adult was, on average 8 per cent. For those born into the middle quintile, the probability of jumping into the top quintile was approximately 20 per cent. The probabilities of being able to climb varied greatly, however, by geographical area within the United States. Moreover, the probability of upward mobility is driven by various characteristics, such as ethnic origin, parents' income level, family characteristics, social network dynamics, and educational background. When analysing the top 1 per cent, the authors found no correlation between top income earners and intergenerational mobility. As Chetty et al. (2014a) noted, 'the factors that

[5] Research on top income mobility is scarce as panel data on high incomes is difficult to obtain (Jenderny 2013). Moreover, studies dealing with this subject are mostly conducted in developed countries and use panel data from income tax records.

erode the middle class hamper intergenerational mobility more than the factors that lead to income growth in the upper tail.'

For Canada, Saez and Veall (2005) analysed income mobility for high-income earners using a large panel of data based on tax returns over the period 1982–2000. The authors found that mobility for high-income earners has not significantly increased since 1982 and suggest that the surge in top incomes is associated with an increase in long-term income concentration. At the intergenerational level, Corak and Heisz (1999) analysed the degree of mobility among Canadian men, by using the Canadian tax returns database. The results show that the extent of intergenerational earnings mobility is much greater at the lower end of the income distribution than at the very top. Corak and Heisz (1999) suggest that in Canada there is less stickiness at the top, and a much higher probability of bottom decile sons rising to the middle of the distribution than in the United States.

For France, Landais (2009) found very similar results as obtained for Canada. The author calculated the probability of staying in the top 1 per cent and in the top 0.1 per cent groups of the income distribution over the period 1996–2006, and he found that income mobility is low and stable at the top of the distribution and it does not explain the recent surge in French top income shares.

For Sweden, Björklund et al. (2012) found that intergenerational transmission between fathers and sons remained strong at the very top of the income distribution. While Sweden has traditionally been considered as a country with a high level of intergenerational mobility, results suggest that above the top 0.1 per cent transmission is high and likely driven by inherited wealth.

For Germany, (Jenderny 2013) found that income mobility among top individuals is stable over the 2001–06 period, and the probability of remaining in the top 0.1 per cent in Germany after one year is very comparable with results from Canada and France. Furthermore, the author suggests that, after three years, top income individuals are less mobile than in Canada and France.

Trends of income mobility raise some questions about how much economic mobility there is in Ecuador. Are top income individuals more mobile than middle income individuals? Given the declining trend in income concentration in most Latin American countries in recent years, would we expect to find more mobility through the income distribution? In other words, does the economic elite change with the reduction of income inequality? Based on the literature on top incomes, which shows no change in mobility with income concentration, we propose the following hypothesis:

> ***Hypothesis H1*:** Income inequality's declining trend has not improved income mobility at the very top.

If ***H1*** were true, most top income individuals should stay in the top of the distribution by the final year and should be less mobile than individuals placed in middle income fractiles. Consequently, the proportion of top income individuals who remain in the top should be greater than the proportion of top income individuals who drop to the bottom 95 per cent or to the bottom 99 per cent.[6] The proportion of individuals staying in the top of the distribution should be greater than the proportion of individuals staying in a specific middle-income fractile.

[6] We analysed the 95 per cent and the 99 per cent thresholds to assess in greater detail the spread of movements of the economic elite.

2.3 Income mobility in Latin America and hypotheses

As mentioned in the introduction, empirical evidence on intragenerational or intergenerational income mobility using longitudinal data is scarce in most Latin American countries. Most studies are based on repeated cross-sectional surveys, or on mean-based pseudo-panel techniques, with no particular emphasis on top incomes.

Among studies that shed some light on income mobility patterns for this region, we can mention: Navarro (2006) who analysed income mobility for Argentina; Calónico (2006) who measured mobility for a set of eight Latin American countries;[7] Cuesta et al. (2011) for a set of 14 Latin American countries;[8] Canelas (2010) for Ecuador; and more recently Cruces et al. (2013) for Chile.

Two main trends arise from these studies. First, different mobility results are obtained for the same country because of different income definitions, geographic area assumptions, or time spans. For instance, Navarro (2006) found a higher degree of income mobility in Argentina for the period 1985–2004 than did Calónico (2006), who measured mobility over the period 1992–2004. Second, outcomes varied depending on the type of database used to measure mobility. As an example, Cruces et al. (2013) measured mobility in Chile over the 1996–2006 period by employing real-panel data and pseudo-panel data. The results suggested that pseudo-panel techniques underestimated the degree of income mobility or the percentage of individuals crossing a lower or an upper bound.[9] To overcome this methodological issue, Fields (2009) suggests that panel data is ideal for analysing income mobility because income dynamics of the same unit of interest (i.e. individual or household) can be observed and measured over time. Unfortunately, few long-term panels are available in Latin American countries, and most evidence on income mobility is based on these methodologies (Ferreira et al. 2013).

The recent economic report from the World Bank about economic mobility in Latin American countries (LAC), documented high levels of intragenerational mobility over the past 20 years. By employing a synthetic panel,[10] Ferreira et al. (2013) found that almost 43 per cent of Latin American individuals had experienced changes in their economic status over recent years. The results suggest that those individuals who are poor or near poverty benefited the most from upward mobility. While almost 2 per cent entered in a poverty status, 23 per cent got out of poverty, and 18 per cent entered the middle class. According to this report, intragenerational mobility in Ecuador follows the same pattern as other Latin American countries. From 1995 to 2009, almost 53 per cent of the population had experienced an upward income movement. Nearly 23 per cent had moved into the middle class, and 30 per cent had got out of poverty.

Based on this literature, we propose the following hypothesis:

> ***Hypothesis H2***: There has been a high degree of upward income mobility in Ecuador over the past years.

If ***H2*** were true, the proportion of individuals moving up in the income distribution would be greater than the proportion of individuals moving down or remaining stable.

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[7] Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Uruguay, and Venezuela.

[8] Argentina, Brazil, Bolivia, Chile, Colombia, Costa Rica, Honduras, Mexico, Panama, Paraguay, Peru, El Salvador, Uruguay, and Venezuela.

[9] In fact, Cruces et al. (2013) show that when working with pseudo-panel techniques the different definitions of 'clusters' affect income mobility results.

[10] Synthetic panels are constructed based on household surveys of 18 Latin American countries.

Moreover, we could expect that this upward income mobility is mainly experienced by individuals in the lowest deciles of the distribution because they are bound to move down and because Ferreira et al. (2013) demonstrated that individuals in the bottom of the distribution move up the most in Latin American countries, including in Ecuador. We can therefore test the following hypothesis:

> ***Hypothesis H3***: Upward mobility is mainly explained by the initial position in the income distribution.

If ***H3*** were true, the *explanatory power* (the R2) of a regression of economic mobility on the initial position would not be improved so much by adding control variables such as gender or education.

If we can expect that the initial position offered the strongest explanatory power to economic mobility, the literature explains that education is also an important factor for reducing income inequality (Piketty 2013). We can therefore test the following hypothesis:

> ***Hypothesis H4***: The upward *economic effect* of education on income mobility should be more, or as important, as the initial position.

Consequently, we could expect that the centile upward effect of education is greater than the centile upward effect of the initial position.

3 Data and methodology

The availability of data determines the possibility of analysing income dynamics. We use panel data[11] from individual income tax returns from 2004 to 2011[12] and information on individual characteristics such as age, gender, marital status, geographical region, and level of education of some tax filers from the Ecuadorian Civil Registry.

Income tax returns data are compiled every year by the Ecuadorian Internal Revenue Service and contain information on all individuals who have submitted their income tax returns. For every tax filer we have the following information: (i) labour income: wages and salaries from formal employees and the self-employed; (ii) capital income: dividends, interest, and other investment income; (iii) business income and other income items; and (iv) tax deductions and taxes paid.[13] Moreover, income in Ecuador is declared in US$ and income taxes are assessed at the individual level, not at the family level.[14] Tax income data were obtained from three types of tax forms: form 107, form 102A and form 102. Tax form 107 reports salaries and wages from formal employment; tax form 102A reports wages, self-employment income, capital returns, and other possible sources of income; and tax form 102 presents income information from taxpayers required to keep accounting books (e.g. individuals with commercial activities or professionals).

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[11] As discussed above, research on income inequality requires data that follows changes in income of the same unit of interest i.e. individual or household, over different periods of time. For instance, Fields (2009) suggests that panel data is ideal to analyse mobility.

[12] Unfortunately, we cannot go back prior to 2004 because electronic tax records in Ecuador are only available since the early 2000s.

[13] The tax database is composed of 85 variables for each year. For 2011, we have 2.3 million observations.

[14] In countries like France, Ireland, the Netherlands, Switzerland, or the United States, the tax unit is a married couple or single individual.

Using tax data certainly implies both advantages and disadvantages. One of the main advantages when focusing on the top of the distribution is that tax returns data overcome the problem of sampling and self-report biases from household surveys (Atkinson et al. 2011).[15] While household surveys can only include a few high-income individuals, tax data include a much larger and more detailed sample of the highest income taxpayers. Conversely, tax evasion or tax avoidance can be a problem for studies employing income tax data. Still, Atkinson et al. (2011) suggest tax returns provide a more accurate measure of income for middle- and upper-income individuals than most survey data.

To assess income mobility in Ecuador, we proceed in three steps. First, to capture the heterogeneity of the top decile and to test ***H1***, we analyse income mobility at the very top of the distribution.[16] For this, we follow Piketty (2001) and Piketty and Saez (2003), and construct annual series of top shares of income by relating the amounts of individual income tax returns (numerator of the top share) to a comparable control total for full population (denominator of the share). Control variables for total income and total population rely on the National Employment and Unemployment Survey (ENEMDU). This quarterly household survey is conducted by the Ecuadorian Statistical Office (INEC) and provides information on income sources: labour, capital, and other types of income, and information on socio-economic characteristics of the population. Once top income series have been constructed, we estimate the probability of remaining in the top income groups over different periods of time. Then, by utilizing transition matrices, we look at movements of individuals across top percentiles and over time.

Second, to test ***H2***, we analyse income mobility for all tax filers from 2004 to 2011. By utilizing transitions matrices, we compute the probability of staying in each income group by the end of the period. Tax filers are grouped by income deciles. Upward and downward movements are illustrated by transition matrices. While for top income shares, we use control variables for total income and total population, in this part, income deciles are constructed relative to the total tax-filing population. This is mainly because, when relating the total number of tax filers to the potential number of tax units aged 20 and over, we are able to capture, for instance for 2011, 25 per cent of the total population. Because of this methodological difference, we have to be cautious when interpreting results from the tax database. The top 5 per cent, constructed with the tax database while controlling for total income, represented the last 22 centiles in 2008 or the last 19 centiles in 2011 of the tax database without control variables.[17] Interpreting the last two deciles of the tax database is nearly equivalent to interpreting the results of the top incomes analysis. The analysis of the middle class utilizing the tax database should focus on deciles below the ninth decile. Moreover, analysing in absolute terms the third decile of the tax database is equivalent to analysing the fourth or fifth decile of the household surveys. Analysing the seventh or eighth decile from the tax database is close to analysing the ninth decile of the household surveys (see Table A1). While there might be some limitations for the lowest-income deciles, the tax returns data allow us to measure changes in income of most middle- and upper-income individuals for a seven-year period.

Third, to test ***H3*** and ***H4*** we analyse the factors associated with mobility in Ecuador. We estimate transition probabilities of upward or downward movement by utilizing a multinomial logit model and a generalized ordered logit model while controlling for some characteristics usually associated

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[15] For a sampling correction, surveys could exclude the very highest-income individuals.

[16] The top incomes literature has demonstrated that the top decile is very heterogeneous in terms of income composition and in terms of income volatility. In most countries, movements of the top decile are driven by the top 1 per cent.

[17] The top 1 per cent began in the 96th centile of the tax database in 2008 and began in the 97th centile in 2011.

with mobility, such as the initial position in the income distribution, age, gender, marital status, education, and geographic region.

Nevertheless, transition probabilities across deciles can hide a variety of situations. Crossing a decile is indeed possible thanks to a movement of one centile or with a movement of 19 centiles. To provide a more accurate picture of mobility, we mobilize two other methods. First, we employ a multinomial logit model to assess upward and downward movements of at least ten centiles from a given initial position. Second, we follow Auten and Gee (2009) and employ a logistic model to measure the change in the percentile position of an individual from 2008 to 2011. There were more than 1.9 million tax filers in 2008 and more than 2.3 million in 2011. We are able to analyse mobility while controlling for initial position of the 1,408,497 tax units present in both years. Other information on age, gender, level of education, geographical region of origin, and marital status was obtained from the Ecuadorian Civil Registry for tax filers present in the tax database of 2008. Civil information was extracted in 2009, but tax information on 2008 was updated during 2009 and after. Consequently the databases do not match perfectly (we lost 36 per cent of the 1.4 million observations). Moreover, civil information was available only for tax form 107 filers and tax form 102A filers (we lost 12 per cent of the observations). We do regression analysis with all control variables on a final sub-sample of 737,891 observations.

Six types of explanatory variables are considered: the initial position in the income distribution, i.e. ten deciles, age,[18] gender (1 = men, 0 = women), marital status (1 = married, 0 = otherwise), level of education (1 = high school and more, 0 = less than high school),[19] and geographical region.[20] The region of birth is used as a proxy for the region of residence to take into account economic shocks across different regions. It is therefore important to assess the relevance of this proxy. According to the population census of 2010 (see Table A2.1), two-thirds of the residents of the Centre, Coast, and North are from these regions. Three-quarters of residents of the South are from this region. More than 90 per cent of the residents of Guayas and Pichincha are from these regions, which are, respectively, the economic and political centres of Ecuador. Despite migration flows, the region of birth appears to be an acceptable approximate of the region of residence. Moreover, Gray (2009) demonstrated that poverty and environmental conditions are the main determinants of internal rural migration in Ecuador. The poorest rural Ecuadorians probably do not belong to the tax-filers database, and it can be assumed that this population will not bias the region of birth as a proxy of the region of residence. Finally, it is worth noting that international migration is mostly concentrated in the southern region and that it is highest among land-rich households, which probably will impact on local development thanks to remittances (Gray 2009; Requier-Desjardins 2010).

4 Top income mobility

[18] Six age classes: up to 20 years, 20–29 years, 30–39 years, 40–49 years, 50–59 years, and 60 years and more.

[19] It is worth noting that detailed level-of-education categories are available in the database. However, we separate the information into two principal categories, 'less than high school' and 'high school and above', because educational data are not automatically updated when, for instance, individuals obtain a university degree. On the contrary, there is a compulsory updating when individuals reach the age of majority, i.e. 18 years old, when the high-school degree has generally already been obtained.

[20] We construct six regional variables based on the geographical region of origin: (i) North includes the provinces of Carchi, Imbabura, Esmeraldas, and Sucumbios; (ii) Centre includes the provinces of Bolivar, Cotopaxi, Chimborazo, Napo, Pastaza, Tungurahua, and Orellana; (iii) South includes the provinces of Azuay, Canar, Loja, Morona Santiago, and Zamora Chinchipe; (iv) Coast includes the provinces of El Oro, Los Rios, Manabi and Galapagos; (v) Pichincha includes Quito the capital city; and (vi) Guayas includes Guayaquil, the biggest city of the country.

4.1 Constructing top income shares

In this section, we construct top income shares for the period 2004–11. As is commonly proposed by the top incomes literature (Atkinson and Piketty 2007; Atkinson et al. 2011), we first construct the top 1 per cent (denoted as P99–100) series, and then we construct series for a number of finer fractiles: P99.5–100 (the top 0.5 per cent), P99.9–100 (the top 0.1 per cent), and P99.99–100 (the top 0.01 per cent).

Every fractile is constructed relative to the total number of potential tax filers in the entire Ecuadorian population. Following the top incomes literature, this number is computed using estimates of the adult population (adults aged 20 and over) and should not be interpreted as the actual number of tax filers. Table A2.2 presents thresholds and the average income level in each fractile, along with the number of tax units in each fractile, all for 2011. To belong to the top percentile (P99), which included nearly 47,000 individuals, the income needed was PPP US$64,231. The average income of the bottom half of the top percentile (1–0.5 per cent) was nearly PPP US$75,000, and to belong to the top 0.001 per cent, an individual needed almost PPP US$1.9 million.

Income is defined as being prior to personal income taxes. The income definition for top incomes and income mobility includes all items reported on tax returns: salaries and wages, pensions, self-employment, unincorporated business net income, dividends, interest, other capital and rents income, and other income items, minus legally deductible expenses[21] and employees' social security contributions.

We then estimate shares of income by dividing the income amounts accruing to each fractile (P99–100, P99.9–100, P99.99–100) by the total personal income reported by the Ecuadorian household surveys.[22] Figure A2.1 displays the income share of Ecuador's top 1 per cent from 2004 to 2011, and Figure A2.2 decomposes the top percentile into three groups: the top 1–0.5 per cent, the top 0.5–0.1 per cent, and the top 0.1 per cent.[23]

4.2 Top incomes persistence

Once top income series have been constructed, we analyse the probability of staying at the top of the distribution after one, two, and three years. Linking with our first hypothesis we expect to find greater income mobility at the top of the distribution if the decline in top income shares reported since 2009 is permanent.

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[21] To make our income definition accurate we did not take into account 'other personal deductions' related to personal living or family expenses because taxpayers would have tended to increase these personal deductions to reduce taxable income.

[22] The total income denominator is constructed by taking into account all sources of income reported by household surveys: wages and salaries income, self-employment income, capital income, transfer income, and secondary income, minus employees' deductions. Moreover, total income is weighted by the expansion factor provided by the INEC and annualized. Household surveys correspond to the month of December of each year.

[23] Although the level of income concentration remained high, almost 20 per cent of total income was obtained by the top 1 per cent of the population; Figure A2.1 shows a declining trend for the very top groups since 2009. Furthermore, in a previous work (Cano 2014) we tested different definitions of income at both the numerator and the denominator of the share, and we constructed shares using different controls for total income and total population from National Accounts, census estimates, and surveys. In 2011, the income accruing to the top 1 per cent group was almost 20 per cent when using external controls for total income and population based on surveys (approximately 40 per cent of GDP), and between 12 per cent and 15 per cent when using a control total for income based on national accounts (approximately 65 per cent of GDP) and different definitions of income at the numerator of the share.

To test this hypothesis, we follow Saez and Veall (2005) and Landais (2009) and compute the probability of remaining in the top 1 per cent, top 0.1 per cent, and top 0.01 per cent after different periods of time. Figure A2.4 reports that the probability of remaining in the top 1 per cent one year later is on average 65 per cent, two years later is 56 per cent, and three years later is 49 per cent. Looking at this figure, we can distinguish two main trends. First, the results suggest that mobility at the top 1 per cent is very modest. Over the last three years, the probability of staying in the top 1 per cent is nearly 70 per cent. Second, the series demonstrate a declining trend between 2007 and 2008. The probability of staying in the top 1 per cent declined from approximately 70 per cent to almost 45 per cent. Nevertheless, since 2008 the series recover the level seen before 2007, and it remains stable for the rest of the period. Following the same methodology, Figure A2.5 shows the probability of remaining in the top 0.1 per cent, and Figure A2.6 shows the probability of remaining in the top 0.01 per cent, after the same periods of time. For the top 0.1 per cent the probability of staying one year later is on average 50 per cent and for the top 0.01 per cent is almost 32 per cent. Both figures demonstrate the same declining trend in 2007, seen in Figure A2.4, followed by a recovery for the rest of the period.

While the series on the top 1 per cent have the highest probability of staying in this position after one, two, or three years, the series on the top 0.01 per cent present a lower staying probability. This trend could suggest that the top 0.01 per cent income group is highly transient over time. Moreover, we have a plausible explication for the declining trend observed in the year 2007. In Figure A2.1 we can see that there is a significant difference in top income shares between the 2004–07 and 2008–11 periods. We advance the hypothesis that the gap registered before and after the year 2007 is mainly explained by a reinforcement of tax collection and by an expansion of the fiscal data, rather than by an increase in income inequality. Indeed, Figure A2.3 shows that personal income tax coverage increased from 17 per cent to 22 per cent between 2007 and 2008, and to 25 per cent in 2011, while it was only 14 per cent in 2004. Consequently, the declining pattern observed mostly in Figures A2.4 and A2.5 in 2007, could be explained by the entry of new tax units with higher incomes than tax units which were in the top in 2007. Indeed, some tax units that belonged to the top 1 per cent in 2007 were probably no longer there from 2008 onwards, because top income thresholds were higher than in 2007.

To the best of our knowledge, estimates of top income mobility for South American countries are only available for Chile. Fairfield and Jorratt (2014) found that 60 per cent of taxpayers who were in the top 1 per cent in 2005 remained within that fractile after four years. And for the top 0.1 per cent, the authors found that 43 per cent of taxpayers remained in that fractile four years later. Moreover, our results are also quite similar to Canadian, French, and German top income mobility findings. Saez and Veall (2005) demonstrated that the probability of remaining in the top 0.1 per cent group in Canada was approximately 60 per cent after one year, and between 50 per cent and 40 per cent after two and three years, respectively. Landais (2009) found that the probability of staying in the French top 0.1 per cent was, on average, 67 per cent after one year, 50 per cent after two years, and 40 per cent after three years, and this trend remained stable over time. For Germany, Jenderny (2013) found that the probability of staying in the top 0.1 per cent was 60 per cent after one year and 50 per cent after three years.

4.3 Transition between top fractiles

Given the level of persistence of top income groups described above, one important question is whether individuals from top income groups move among the economic elite or are more likely to drop to the bottom 95 per cent after a period of time. We examine in greater detail movements

of individuals across top fractiles using transition matrices.[24] The rows of our transition matrices correspond to the top percentiles at origin (i.e. first year of a given period) and the columns correspond to top percentiles at destination. Diagonal entries present the 'stayer groups', in other words the persistence rate of top units over time. Thus, we are able to know how many individuals end up in the same top percentile at the end of a given period of time, and also movements into and out of the top income groups.

Following Jenderny (2013), fractile members of each matrix are reported net of the next richer fractile. For instance, individuals who are members of the annual top 1 per cent are not present in the annual top 0.1 per cent or in the annual top 0.01 per cent. Table A2.3 refers to the base year 2004 and shows transitions to 2011. Further, Table A2.4 shows transitions for 2008 to 2011.

The diagonal entries of Table A2.3 demonstrate that the rate of persistence in the net income fractiles tends to decline with higher fractiles. While nearly 49 per cent of the top 5 per cent stayed in this group by 2011, only 11 per cent of the top 0.05 per cent and 10 per cent of the richest top 0.01 per cent remained in the same group by 2011. The vast number of top income tax filers at the beginning of the seven-year period were absent from their respective top groups seven years later.

Table A2.4 presents a different pattern. First, persistence rates were higher than those observed in Table A2.3, suggesting that the highest income individuals were more present in this three-year group than in the seven-year group. Second, persistence rates increased within the three net richest groups: top 0.1 per cent, top 0.05 per cent, and top 0.01 per cent. While 14 per cent remained in the top 0.1 per cent, almost 22 per cent and 25 per cent of the top 0.05 per cent and top 0.01 per cent had remained in their respective groups by 2011. Persistence rates also increased between the top 1 per cent and the top 0.5 per cent percentiles: 30 per cent had remained in the top 1 per cent, and nearly 37 per cent had stayed in top 0.5 per cent by 2011.

Regarding income mobility dynamics between the economic elite, Table A2.3 demonstrates that nearly 82 per cent of individuals placed in the top 1 per cent (i.e. 82.3 = 100-17.7) in 2004 had moved to a different percentile by 2011. Almost 13 per cent had moved to a higher top percentile, and approximately 70 per cent had dropped to a lower top percentile, of which 50 per cent had gone to the top 5 per cent and only 20 per cent had dropped to the bottom 95 per cent. The same trend is found for the top 0.1 per cent in this period. While almost 7.5 per cent had moved up to a higher top income percentile, nearly 83 per cent had fallen to a lower top income percentile, but only 24 per cent had dropped to the bottom 95 per cent by 2011. Put differently, only 24 per cent had left the economic elite group by 2011.

Table A2.4 presents the top income mobility dynamics for the 2008–11 period. Approximately 71 per cent (i.e. 70.7 = 100-29.3) of individuals in the top 1 per cent had moved by 2011. While 24.3 per cent had risen to a higher top percentile, 30 per cent had fallen to the top 5 per cent, and approximately 16 per cent had dropped to the bottom 95 per cent. The top 0.1 per cent was also mobile across top percentiles in this period. Approximately 87 per cent of individuals (i.e. 86.5 = 100-13.5) in the top 0.1 per cent had moved to a different percentile. Of this percentage, 19 per cent had moved to a higher top percentile by 2011, 47 per cent had fallen between the top 5 per cent and top 0.5 per cent, and 20 per cent had dropped to the bottom 95 per cent. The bottom row describes the movement of the top 0.01 per cent: 50 per cent had fallen between the top 1 per cent and the top 0.05 per cent, and only 24 per cent had dropped to the bottom 95 per cent by 2011.

[24] In this section, Markov transition matrices are computed using a counting method.

The results of Tables A2.3 and A2.4 reveal an important degree of mobility in top incomes in both periods 2004–11 and 2008–11. Nevertheless, most of this movement happened between the top 5 per cent and top 0.01 per cent. The percentage of individuals who had dropped to the bottom 95 per cent by the final year, in both periods, was less than the percentage of individuals who had left their top income groups but remained among the economic elite.

From our Ecuadorian top income series findings, it appears that mobility does not explain the decline of top income shares seen since 2009 (Figures A2.1 and A2.2). Put differently, if the decline in the top income shares was permanent, we should find, in theory, more mobility in the economic elite group since 2009. However, top income mobility dynamics suggest that the persistence rate is higher between top incomes and that most of the movement happens within the economic elite. These results clearly validate ***H1***.

5 Factors associated with income mobility

This section first presents income mobility patterns for the entire distribution over the period 2004–11. Then, we focus on the period 2008–11, for which we have control variables to analyse the factors associated with income mobility.

Our previous evidence suggests that the probability of remaining in the top incomes groups is high and the proportion of individuals who drop to the bottom 95 per cent is less than the proportion of individuals who remain among the economic elite by the end of the period. We now examine income mobility dynamics relative to the population of total tax filers. Linking with our second hypothesis, we expect to find an upward income mobility trend, especially at the bottom and at the middle of the distribution.

The results from Table A2.5 demonstrate an important degree of mobility of tax filers during the 2004–11 period. On average, nearly 63 per cent of tax filers placing in the fourth decile (i.e. 63.2 = 100-36.9) had moved into another decile. While 25 per cent had dropped to a lower income group, more than 38 per cent had moved to a higher income decile. The same trend was observed for the fifth to eighth middle income deciles. Nearly 30 per cent of individuals placing in these deciles had experienced an upward movement, and on average 23 per cent had dropped to a lower income group. Concerning the probability of remaining in any decile, diagonal entries show that approximately 40 per cent of tax filers placing in the fifth to eighth deciles in a given year were still in those deciles the next year.

To better understand the factors associated with income mobility, we use the longitudinal tax database described in Section 3 and information on individual characteristics from the Ecuadorian Civil Registry for the 2008–11 period. Markov transitions probabilities and regressions are implemented on 1.4 million observations, of which 737,891 observations have control variables information. We organize our analysis into three parts. In the first part, we calculate Markov transition probabilities from positions in the income distribution in 2008 to income positions in 2011 utilizing three different methods. The second part utilizes a multinomial logit model to estimate the odds of experiencing an upward or downward movement of at least ten centiles. The third part utilizes a logistic model to measure changes in the centile position of tax filers by the end of the period.

5.1 Markov transition probabilities

To compute Markov transition probabilities from income positions in 2008 to income positions in 2011, we use three different methods. The first method is a counting procedure. The second method predicts transition probabilities employing a multinomial logit model. Then, the third

method predicts transition probabilities utilizing a generalized ordered logit model. The latter two methods are controlled by the explanatory variables described in Section 3.

We begin by counting the number of transitions of each unit of observation at the final year $t =$ 2011 and the initial year $t - 3 =$ 2008, and then we estimate the probability of moving from one income decile to another. Let's denote η_{xj} the number of tax filers who were in decile x in year $t - 3$ and now are in decile j in year t. Using the following formula we can estimate the probability p_{xj} of a tax filer being in decile j in year t, given that he was in state x in year $t - 3$:

$$p_{xj} = \frac{\eta_{xj}}{\sum_{j=1}^{10} \eta_{xj}}$$

The probability of transition from any given decile x is equal to the number of tax filers that started in decile x and ended in decile j as a proportion of all tax filers that started in decile x.

The second method uses a *multinomial logit model* to predict transition probabilities in the income position from 2008 to 2011. The multinomial logit model in this part takes the form of:

$$\Pr(y_i = j|X) = \begin{cases} \dfrac{1}{1 + \sum_{m=2}^{10} \exp(X_i\beta_m)}, & \text{if } \ j = 1 \\ \dfrac{\exp(X_i\beta_j)}{1 + \sum_{m=2}^{10} \exp(X_i\beta_m)}, & \text{if } \ j = 2, 3, \ \ldots 10 \end{cases}$$

where X_i is the vector of explanatory variables for the jth observation and β_j is the vector of parameters to be estimated for each jth outcome. The dependent variable takes ten different outcomes: 1 if first decile, 2 if second decile, 3 if third decile, …10 if tenth decile.

Because of natural ordering in the deciles' positions, the third method uses a *generalized ordered logit model*[25] where predicted probabilities are calculated as:

$$\Pr(y_i = j|X) \begin{cases} \dfrac{\exp(\alpha_1 - X_i\beta_1)}{1 + \exp(\alpha_i - X_i\beta_1)}, & \text{for } j = 1 \\ \dfrac{\exp(\alpha_j - X_i\beta_j)}{1 + \exp(\alpha_j - X_i\beta_j)} - \dfrac{\exp(\alpha_{j-1} - X_i\beta_{j-1})}{1 + \exp(\alpha_{j-1} - X_i\beta_{j-1})}, & \text{for } j = 2 \text{ to } J - 1 \\ 1 - \dfrac{\exp(\alpha_{J-1} - X_i\beta_{J-1})}{1 + \exp(\alpha_{J-1} - X_i\beta_{J-1})}, & \text{for j = J} \end{cases}$$

where α are ordered estimated cutpoints and where j ranges from 1 to 10.

[25] A Brant-Wald test shows that the parallel regression assumption in an ordered logit model is violated. Consequently, we use a generalized ordered logit model which relaxes this assumption and allows estimations of different coefficients for different outcomes.

Table A2.6 presents Markov transition probabilities obtained with these three methods. Deciles were computed on the entire tax filing population, but transition probabilities were computed for survivors in 2011.[26] Panel A presents transition probabilities for the full population. The results are the same when employing the three methods described above. Panel B presents transition probabilities for the sub-sample. Again, the results are the same when utilizing the three methods without control variables, and for the predicted probabilities from the multinomial logit model with control variables. Panel C presents predicted probabilities from the generalized ordered logit model when they are conditioned by control variables. Probabilities are only slightly modified compared to panel B.

The results from the panels suggest an important degree of mobility especially among middle income deciles.[27] For instance, 87 per cent (i.e. 87 = 100-13) of tax filers from the second and the third deciles had moved by 2011. Between 75 per cent and 66 per cent of tax filers respectively, placing in the fourth and the eighth deciles, had moved by 2011. A much larger portion of tax filers had risen to a higher income decile than had dropped to a lower decile. Nearly 55 per cent of individuals belonging to the fourth decile had moved to a higher decile, and 20 per cent had dropped to a lower decile. Patterns are similar for fifth to eighth deciles. Consistent with previous top income mobility analysis, diagonal entries demonstrate that the level of persistence increases with higher deciles.

These results suggest that tax filers in the middle deciles (third to eighth deciles of the tax database) are more likely to experience an upward movement (56 per cent on average) than a downward movement (19 per cent on average) or simply no movement (25 per cent on average) by the final year of the period. Linking with our hypotheses, these results clearly validate ***H1*** and ***H2***.

To obtain more detail about the main factors that influence transition probabilities, Figures A2.7 to A2.16 present probabilities from the multinomial logit model described above. The probabilities are predicted at the mean of regions and change as a function of decile origin, age, gender, and education.[28] Changes in predicted probabilities suggest that having a high-school degree highly influences the probability of rising in the income distribution. For instance, probabilities of advancing are higher for tax filers starting in the sixth decile and who have a high-school degree. Conversely probabilities of falling in the lowest deciles are higher for those starting in the sixth decile and who do not have a high-school degree. Moreover, tax filers starting in the first five deciles and who have a high-school degree are more likely to move into the fifth or fourth last deciles. Regarding life-cycle, the probability of reaching the first three deciles decreases with age regardless of initial positions. The probability of reaching the fourth to seventh deciles increases with age (with a less clear pattern for the fifth decile) and the probability of reaching the last three deciles decreases with age (with a less clear pattern for the ninth and tenth deciles).

Certainly we are faced with a methodological limitation. As noted by Auten and Gee (2009), some individuals might have crossed a decile by moving only a few income centiles while others could have moved several income centiles. Unfortunately, these movements cannot be seen in our transition matrices. To overcome this methodological issue, we employ two additional methods.

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[26] Table A2.7 presents probabilities from 2008 to 2011 computed relative to the panel population.

[27] Recall that the lowest deciles in the tax database probably capture middle-income deciles in household surveys (see Table A1).

[28] For this purpose we create four cross-variables of gender and education: EDUCMAN, EDUCWOMAN, NONEDUCMAN, NONEDUCWOMAN.

The first one captures movements of at least ten centiles. The second one measures the change in the percentile position of individuals following the method proposed by Auten and Gee (2009).

5.2 Strong movements predicted by a multinomial logit model

The multinomial logit model in this subsection takes the same form as the multinomial logit model described in Section 5.1, where *j* has three categories: 1, if no movement or weak movement (between -10 and 10 centiles); 2, if strong upward movement; and 3, if strong downward movement, where 'strong' means a movement greater than ten centiles. Estimates give the probability of 'strong upward mobility' or 'strong downward mobility' relative to the base category of 'weak or no movement'.[29]

Table A2.8 presents multinomial logit regression results. Coefficients are reported as 'relative risk ratios rrr', which indicate the relative risk associated with a one-unit change in the explanatory variable.[30] The first specification includes variables of the initial position in the income distribution for the entire population.[31] For those tax filers starting in the first three deciles, the relative risk of experiencing an upward movement rather than a weak movement is expected to increase by a factor of between 2.1 and 3.1. On the contrary for individuals starting in the fourth decile and higher, the relative risk of moving up rather than experiencing a weak or no movement is expected to decrease by a factor of between 0.9 and 0.09. The risk of falling rather than moving slightly decreases by a factor of between 0.16 and 0.38 for all initial positions. The second specification includes regional variables[32] which do not qualitatively modify the results. The third specification includes initial position and regional variables for the sub-sample, for which we have other control variables. The results are unchanged. The fourth specification includes variables of age.[33] When age is added, being in the second or the third deciles does not increase the odds of rising rather than not moving. In models 5 and 6, when all control variables are added the risk of moving down or moving up, rather than moving slightly or not moving, decreases regardless of initial positions. It is therefore worth analysing which are the other determinants that increase the odds of moving up by more than ten centiles.

Education is the most important determinant that influences upward movements. Having an educational degree increases the odds of moving up by a factor of 2.0. Moreover, being a woman with an educational degree rather than being a woman without an educational degree increases the odds of moving more than ten centiles by a factor of 2.9. These results validate ***H4***.

Factor changes of region, marital status, or gender variables are quite low.[34] Being in Guayas—the economic centre— provides a higher relative risk of rising or falling than being in other regions (the respective rrr are 1.4 and 1.3 relative to the North region). Being in the South region

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[29] The frequency of the dependent variable is the following: 39 per cent for outcome 1 (35 per cent of weak movement, and 4 per cent of no percentile movement), 43 per cent for outcome 2, and 18 per cent for outcome 3.

[30] Recall that a factor change greater (less) than 1 indicates a positive (negative) relationship between explanatory and dependent variables. Moreover, a positive and a negative effect have the same magnitude if they are the inverse of each other (e.g. 5 and 0.2).

[31] To analyse the effects of each initial position, we dropped the intercept. The results are qualitatively similar when the constant is added. Because the dependent variable catches an upward or a downward movement of at least ten centiles, the coefficients of decile one cannot be estimated for a downward outcome, and the coefficients of decile ten cannot be estimated for an upward outcome. The results for deciles two to nine are qualitatively similar when we remove observations belonging to deciles one and ten.

[32] North is the omitted region.

[33] Sixty years and more is the omitted category.

[34] Wald tests show that differences described in this paragraph were always significant.

represents the second highest odds of an upward movement relative to other regions. Nevertheless, differences between all regions are very small. Being less than 50 years old increases the relative risk of experiencing upward mobility rather than moving slightly, relative to individuals being 50 years old or more. Nevertheless, being less than 30 years old increases the odds of experiencing strong downward movements rather than a weak movement relative to individuals being 30 years old and more. Looking at other control variables, being a man increases the odds of moving up or moving down by a factor of 1.2. Being married slightly increases the odds of upward movements and slightly decreases the relative risk of experiencing downward movements rather than not moving.

5.3 Modelling centile effects

In this section, following Auten and Gee (2009), we measure the change in the centile position of individuals over the period 2008–11. As noted by these authors, the simplest way to measure this change would be by computing the difference between two centiles position from the initial to the final period. For instance, an individual moving from the 60th percentile in 2008 to the 70th percentile in 2011 would have climbed ten percentiles. However, if we proceed in this way, the dependent variable would present a consistency problem because the centile range is bounded by 0 to 100. To overcome this methodological issue, Baum (2008) suggests a logit transformation of the dependent variable y and the use of a linear regression to model this transformation as a linear function of a set of regressors:

$$y = \frac{1}{1+\exp(-X\beta)}$$

To obtain y^*

$$y^* = ln\left(\frac{y}{1-y}\right) = X\beta + \epsilon$$

This transformation allows us to model y^* while avoiding problems of estimating a bounded dependent variable. Following Auten and Gee (2009), the dependent variable in this part is defined as:

$$y = logit\ (dcent)$$

$$y = ln\frac{(dcent)}{(1-dcent)}$$

$$dcent = \frac{\frac{1}{2}\ (endcentile - startcentile) + 50}{100}$$

where $dcent$ is a transformation scaled in such a manner that individuals, whose income remains the same at the end of the period, hold a dependent variable with a value of zero. For instance, individuals whose systematic effect is 0.06 would be predicted to increase their relative position in the income distribution by three percentiles, as shown in Table 1.

Table 1: Logit transformation of the centile effect

centile effect	99	…	3	2	1	**0**	-1	-2	-3	…	-99
dcent	0.995	…	0.515	0.510	0.505	**0.500**	0.495	0.490	0.485	…	-0.995
logit (dcent)	5.293	…	0.060	0.040	0.20	**0.000**	-0.020	-0.040	0.060	…	-5.293

Source: Author's calculation.

Table A2.9 presents the results. We remove the intercept from the regressions to observe the effect of each category in the initial position.[35] The first specification model changes in the centile position as a function of the initial position in the income distribution for all observations. Centile effects decrease from a positive to a negative value as the initial position increases. The second specification includes regional variables. The results are qualitatively similar in both models and centile effects remain stable. Starting in the second and third deciles is associated with an upward movement of 25 and 18 centiles respectively by the end of the period. Being in the fourth to seventh deciles is associated with climbing in the income distribution approximately by nine, five, three and two centiles, respectively. Being in the ninth decile is associated with a downward movement of five centiles. The results are unchanged in the sub-sample for which we have all control variables (model 3), except for the first and the tenth deciles which, respectively, decrease from 45 to 35 centiles and increase from -13 to -7 centiles. When adding all control variables (models 5 and 6), there is a declining trend in centile effects for all initial positions. The centile effects decrease by approximately ten points. Starting in the fourth decile is now associated with downward mobility.

While the coefficients of the control variables are highly statistically significant, region of birth, age, being married, being a man, or having a high-school degree added very little to the explanatory power of the model, as shown by the evolution of the R2 (R-squared increases from 0.26 to 0.29). This result validates ***H3***, which stresses the overriding role of initial position in the income distribution to explain mobility.

Most of the control variables are associated with low centile effects. Age variables are associated with an upward movement of three centiles for individuals between 20 and 60 years old relative to those being 60 years old and more. Belonging to the South, Centre, and Guayas regions is associated with a rise of one or two centiles relative to the North region. Consistent with the previous multinomial logit model, the economic effect of region of birth is very low. Furthermore, being a man or being married does not seem to be economically significant because it is associated with rising by one centile.

However, having at least a high-school degree is associated with an increase of approximately nine centiles. In the sixth specification, we decompose the education effect between men and women. The results demonstrate that the constant effect of being a man is associated with an increase of three centiles. Being a man with an educational degree is associated with a rise of eight centiles, while being a woman with an educational degree is associated with an 11 centile rise in the income distribution. A Wald test demonstrates that this difference is significantly different from zero. The difference between the coefficient of the variable EDUCWOMAN and the sum of the coefficients of variables man and EDUCMAN is statistically not different from zero at a 1 per cent significance level. Consequently education appears to reduce the small gender inequality in income mobility because both educated men and educated women are associated with moving up by 11 centiles relative to women without a high-school degree. These results and those of the previous multinomial logit regression validate ***H4***. We can conclude that the demand for skills is an explanation of the reduction of inequalities in a developing country such as Ecuador. This is consistent with recent trends in Latin American countries where the fall in income inequality is partly explained by a decrease in educational inequality among individuals (Cornia 2010). It is also congruent with the argument of Piketty (2013) for developed countries in which the demand for skills does not explain the rise of inequality but may explain the decrease of inequality.

[35] The results are qualitatively similar with the constant.

6 Conclusions

This paper examined income mobility in Ecuador using information reported on individual income tax returns over the period 2004–11. Three main empirical results were obtained.

First, the declining trend of top income shares observed in Ecuador since 2009 has not been accompanied by an increase in mobility at the top of the distribution. Indeed, while controlling by a variable of total population, income mobility at the top of the distribution was low and it remained stable over the 2004–11 period. Moreover, top income individuals were more likely to move between the top 5 per cent and the top 0.1 per cent than to drop to the bottom 95 per cent. The proportion of individuals who dropped to the bottom 95 per cent was lower than the proportion of individuals who remained in the top 5 per cent by the final year. From our results, it appears that top income mobility does not explain the decline of inequality observed since 2009. Put differently, if the decline of top income shares was permanent we should find, in theory, more mobility in top income groups. However, our findings suggest that the persistence rate is high for top incomes.

Second, there was a significant degree of mobility in the middle of the income distribution. Transition probabilities obtained by three different methods (counting procedure, multinomial logit model, and generalized ordered model) suggest that individuals in the middle deciles (third to eighth deciles) are more likely to experience upward movements (56 per cent on average) than downward movements (19 per cent on average) or simply no movement (25 per cent on average). Indeed, a much larger portion of tax filers rose to a higher income decile than dropped to a lower decile over the 2008–11 period. Additionally, to know more about the main factors that influence transition probabilities we created four cross-variables of gender and education, and we found that the probability of moving up in the income distribution was higher for those tax filers starting in the sixth decile and who had a high-school degree. On the contrary, the probability of falling in the lowest deciles was higher for those tax filers starting in the sixth decile and who did not have a high-school degree.

Third, estimates of a multinomial logit model suggested that the initial position in the income distribution was closely associated with the probability of upward or downward mobility over the period 2008–11. Moreover, education was the most important determinant that influences upward movements. Being a woman with an educational degree rather that being a women with no degree increased the odds of moving up in more than ten centiles. Additionally, through a logit transformation of the dependant variable we measured the change in the centile position of individuals. When all control variables were included, our results suggested that being in the first three deciles was associated with an upward movement of 26, 16, and 9 centiles, respectively. And once again, having a high-school degree was associated with an upward movement of 11 centiles. From our results it appears that the demand for skills explains the reduction of inequalities in a South American country such as Ecuador.

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Appendix 1

Comparison of tax data and household surveys

Table A1: Comparison of tax data (TD) and household surveys (HS)

	2008				2011			
Deciles	Mean income US$		In % of next decile		Mean income US$		In % of next decile	
	HS	TD	HS	TD	HS	TD	HS	TD
1	337	184	53%	19%	400	321	53%	24%
2	640	958	53%	49%	753	1,337	52%	49%
3	1,206	1,973	69%	68%	1,450	2,726	65%	71%
4	1,750	2,894	77%	74%	2,215	3,864	78%	79%
5	2,279	3,889	84%	73%	2,855	4,866	83%	78%
6	2,714	5,310	82%	74%	3,428	6,229	85%	76%
7	3,315	7,216	77%	75%	4,011	8,239	81%	74%
8	4,327	9,600	72%	68%	4,938	11,104	72%	71%
9	6,037	14,148	41%	35%	6,903	15,748	46%	38%
10	14,770	40,862			15,110	41,371		

Notes: Table A1 presents average income in every decile and the proportion of average income relative to the next decile's average income. Data for individuals aged 20 and over.

Source: Author's calculation

Constructing top income shares requires the usage of individual income tax data and control variables for total income and total population. Nevertheless, for the analysis of the middle class, household surveys (HS) probably give an accurate picture of the income distribution because tax database (TD) captures only 25 per cent of the adult population. Consequently, we have to be cautious when interpreting results of the TD without controls. For instance, the top 5 per cent constructed with the TD while controlling for total income from HS represented the last 22 centiles in 2008 or the last 19 centiles in 2011 of the TD without control variables.[36] Interpreting the two last deciles of the TD is nearly equivalent to interpreting the results of the top incomes analysis. The analysis of the middle class using the TD should focus on deciles below the ninth decile.

Let us examine the first to eighth deciles in the TD. For the HS and TD, we scrutinize both the absolute value of the mean income by deciles and the proportion of mean income relative to the mean income of the next decile in order to assess whether the relative gap between each decile is the same across the two databases:

- First decile: the mean income of the first decile in the HS is more important than the mean income of the first decile in the TD. Moreover, in 2008 and 2011 the HS demonstrated that the mean income of the first decile is 53 per cent of the mean income of the second decile, while it is between 19 per cent and 24 per cent for the TD. It would be difficult to interpret the evolution of the first decile in the TD which is clearly not representative of the first decile of household survey.

[36] The top 1 per cent began in the 96th centile of the tax database in 2008, and began in the 97th centile in 2011.

- Second decile: the mean income of the second decile in the TD is greater than the mean income of the second decile in the HS, but it is less than the mean income of the third decile in the HS. Moreover, the mean income of the second decile is approximately 50 per cent of the mean income of the third decile in both the household survey and tax database.

- Third decile: the mean income of the third decile in TD is greater than the mean income of the third and fourth deciles in the HS. The mean income of the third decile is between 65 per cent and 71 per cent of the mean income of the fourth decile in both the HS and TD.

- From the fourth to seventh deciles: every mean income of these deciles in the TD is greater than the mean income of the next two deciles in the HS. The mean income of one of these deciles is between 73 per cent and 85 per cent of the mean income of the next decile, with a minimum difference of one percentage point and a maximum difference of 11 percentage points between HS and TD, depending on the decile and on the year.

- Eighth decile: the mean income of the eighth decile in TD is greater than the mean income of the next decile in HS. The mean income of the eighth decile is between 68 per cent and 72 per cent of the mean income of the ninth decile in both the HS and TD.

While the analysis of the first decile in the TD should be ignored, the TD captures upper incomes in a better way. For the second to the eighth decile, absolute revenue is less dispersed for the HS than for the TD. Nevertheless, relative gaps of mean absolute revenue between deciles are close in the two databases from the second to the eighth decile. Mobility between the fourth and seventh (or eighth) decile in the TD probably represents mobility between the sixth and ninth decile in the HS. Moreover, analysing in absolute terms the third decile of the tax database is equivalent to analysing the fourth or fifth decile of the HS. Further, analysing the seventh or eighth decile from TD is closed to analyse the ninth decile in the HS. In this paper, we always refer to the deciles of the TD.

Appendix 2

Table A2.1: Cross-table of region of birth and region of residence

	Region of residence							
Region of birth	Centre	Coast	Guayas	North	Pichincha	South	TOTAL	Match birth-residence
Centre	**942,145**	36,418	81,344	31,465	273,721	17,535	1,382, 628	68%
Coast	35,149	**1,373,638**	397,255	68,486	164,390	28,644	2,067,562	66%
Guayas	15,269	72,983	**1,738,201**	12,134	40,061	20,188	1,898,836	92%
North	16,494	20,596	55,676	**513,918**	163,573	5,601	775,858	66%
Pichincha	28,135	17,295	22,017	28,960	**1,018,561**	10,287	1,125,255	91%
South	25,678	78,974	60,229	19,756	110,354	828,272	**1,123,263**	74%
TOTAL	1,062,870	1,599,904	2,354,722	674,719	1,770,660	910,527	8,373,402	

Notes: Censo de población y vivienda 2010, Instituto Nacional de Estadística y Censos-INEC, Ecuador. Population aged 20 and more in 2010 (18 and more in 2008).

In this paper, the 24 administrative provinces are grouped into six regions:

Centre = Bolívar, Chimborazo, Cotopaxi, Napo, Orellana, Pastaza, Tungurahua
Coast = El Oro, Galápagos, Los Ríos, Manabí
Guayas = Guayas, Península de Santa Elena
Norte = Carchi, Esmeraldas, Imbabura, Sucumbíos
Pichincha = Pichincha, Santo Domingo de los Tschilas
South = Azuay, Canar, Loja, Morona Santiago, Zamora Chinchipe

Source: Author's calculation.

Table A2.2: Thresholds and average incomes in top groups within the top percentile, Ecuador 2011

Thresholds	Income level		Fractiles	Number of tax units	Average income		Average income In % of next threshold
	US$	US$ (PPP)			US$	US$ (PPP)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Full population	9,408,267	$3,296	$6,264	34%
P90	$7,141	$13,572	P90–95	470,413	$9,719	$18,470	50%
P95	$12,897	$24,511	P95–99	376,331	$19,387	$36,845	49%
P99	$33,797	$64,231	P99–99.5	47,041	$39,662	$75,377	63%
P99.5	$47,525	$90,320	P99.5–99.9	37,633	$62,814	$119,378	55%
P99.9	$98,160	$186,552	P99.9–99.95	4,704	£114,830	$218,232	60%
P99.95	$138,004	$262,274	P99.95–99.99	3,763	$191,488	$363,920	40%
P99.99	$311,278	$591,579	P99.99–99.999	847	$476,625	$905,818	19%
P99.999	$1,025,480	$1,948,910	P99.999–100	94	$2,569,580	$4,883,449	

Notes: Computations based on income tax return statistics. Income is defined as being prior to individual taxes. Amounts are expressed in 2011 US dollars.

PPP US$1 = 0.56348.

Source: Author's calculation.

Table A2.3: Top income mobility in Ecuador, transitions between income fractiles 2004–2011

Top Income Mobility in Ecuador (a,b)
Transitions between income fractiles 2004 - 2011
% of net fractile members

	Destination 2011							
Origin 2004	Bottom 95%	Top 5%	Top 1%	Top 0,5%	Top 0,1%	Top 0,05%	Top 0,01%	Total
Bottom 95%	**77.4**	17.4	2.4	2.2	0.3	0.3	0.1	100
Top 5%	44.3	**48.9**	4.1	2.4	0.2	0.1	0.0	100
Top 1%	19.8	50.0	**17.7**	10.9	0.9	0.6	0.1	100
Top 0,5%	19.4	29.3	21.5	**25.1**	2.8	1.7	0.3	100
Top 0,1%	23.9	18.9	10.2	30.3	**9.3**	6.4	1.1	100
Top 0,05%	24.0	17.2	9.9	23.6	10.6	**11.2**	3.6	100
Top 0,01%	35.0	17.1	7.4	12.5	5.8	12.1	**10.1**	100
Total	61.7	29.7	4.3	3.5	0.5	0.4	0.1	100

Notes: Top incomes are based on income tax returns statistics. External control for total population is based on household surveys.

Source: Author's calculation.

Table A2.4: Top income mobility in Ecuador, transitions between income fractiles 2008–2011

Top Income Mobility in Ecuador (a,b)
Transitions between income fractiles 2008 - 2011
% of net fractile members

	Destination 2011							
Origin 2008	Bottom 95%	Top 5%	Top 1%	Top 0,5%	Top 0,1%	Top 0,05%	Top 0,01%	Total
Bottom 95%	**86.7**	12.0	0.7	0.5	0.1	0.0	0.0	100
Top 5%	24.1	**65.2**	7.1	3.3	0.2	0.1	0.0	100
Top 1%	16.2	30.3	**29.3**	22.2	1.3	0.7	0.1	100
Top 0,5%	19.1	18.6	14.0	**37.2**	6.8	3.7	0.5	100
Top 0,1%	20.3	16.3	8.1	22.9	**13.5**	17.1	2.0	100
Top 0,05%	20.7	14.6	8.3	18.7	8.5	**21.6**	7.6	100
Top 0,01%	24.2	16.8	5.9	10.6	4.7	13.0	**25.0**	100
Total	71.0	23.2	2.9	2.3	0.3	0.2	0.1	100

Notes: Top incomes are based on income tax returns statistics. External control for total population is based on household surveys.

Source: Author's calculation.

Table A2.5: Income mobility in Ecuador (a) transitions between income deciles 2004– 2011, % of net deciles members

Income Mobility in Ecuador (a)
Transitions between income fractiles 2004 - 2011
% of net deciles members

	Destination 2011										
Origin 2004	**Decile 1**	**Decile 2**	**Decile 3**	**Decile 4**	**Decile 5**	**Decile 6**	**Decile 7**	**Decile 8**	**Decile 9**	**Decile 10**	**Total**
Decile 1	**45.7**	9.3	8.5	5.41	4.2	3.4	3.5	3.9	5.8	10.4	100
Decile 2	15.8	**22.3**	20.9	16.5	11.4	6.0	3.2	1.9	1.2	0.8	100
Decile 3	8.7	14.5	**22.0**	22.3	14.9	8.4	4.2	2.4	1.5	1.0	100
Decile 4	4.2	7.8	13.4	**36.9**	20.7	8.5	4.1	2.3	1.3	0.9	100
Decile 5	2.8	5.0	7.2	12.5	**37.7**	21.4	7.4	3.1	1.8	1.0	100
Decile 6	2.0	2.7	3.8	3.9	11.6	**42.7**	22.8	6.2	2.9	1.4	100
Decile 7	1.7	1.5	2.1	2.0	3.3	11.9	**45.7**	23.5	6.0	2.3	100
Decile 8	2.1	0.9	1.4	1.2	1.7	3.2	12.3	**49.9**	23.1	4.3	100
Decile 9	2.9	0.8	1.1	0.9	1.2	1.9	3.7	12.9	**55.5**	19.1	100
Decile 10	4.6	0.7	0.9	0.8	0.9	1.1	1.7	3.1	12.5	**73.7**	100
Total	8.3	6.0	7.6	9.9	10.7	11.1	11.3	11.4	11.7	11.9	100

Notes: This table shows income mobility in Ecuador from 2004 to 2011. Income mobility is relative to the total tax filing population.

Source: Author's calculation based on income tax returns statistics.

Table A2.6: Markov transition probabilities

Panel A: Full population without control variables (probabilities obtained by counting transitions or predicted from generalized ordered logit model, or from multinomial logit model)

Origin 2008		Destination 2011											
N	%	DECILE	1	2	3	4	5	6	7	8	9	10	Total	Total 3
90 940	6.5%	1	*16.7*	12.8	12.9	11.4	10.6	9.1	7.0	5.5	5.5	8.6	100	42.4
110 400	7.8%	2	10.6	13.0	14.8	*15.9*	15.7	12.5	7.8	5.2	2.8	1.8	100	46.4
129 258	9.2%	3	6.8	8.8	12.8	18.2	*18.6*	14.7	9.6	5.1	3.3	1.9	100	51.6
142 433	10.1%	4	4.7	6.1	9.9	*24.7*	20.5	14.9	9.2	5.2	2.9	1.9	100	60.2
151 185	10.7%	5	3.5	4.3	6.1	10.2	22.3	*24.0*	15.2	7.9	4.0	2.4	100	61.5
156 316	11.1%	6	2.4	2.7	3.7	3.8	8.4	26.9	*27.8*	14.5	6.2	3.7	100	69.2
160 197	11.4%	7	1.7	1.6	2.2	1.9	2.9	7.6	29.2	*31.7*	16.0	5.1	100	76.9
162 898	11.6%	8	1.4	1.1	1.5	1.2	1.5	2.8	7.9	34.1	*38.6*	9.7	100	82.5
155 070	11.0%	9	1.8	1.2	1.5	1.3	1.5	2.2	4.1	10.6	*42.1*	33.7	100	86.4
149 800	10.6%	10	2.9	1.1	1.8	1.4	1.4	1.8	2.7	4.3	11.7	*71.0*	100	87.0
1 408 497	100%													

Panel B: Sub-sample without control variables (probabilities obtained by counting transitions or predicted from multinomial logit model) or with control variables (probabilities from multinomial logit model)

Origin 2008		Destination 2011											
N	%	DECILE	1	2	3	4	5	6	7	8	9	10	Total	Total 3
28 996	3.9%	1	*15.1*	15.0	14.4	13.4	12.6	11.1	7.2	4.6	3.4	3.3	100	44.4
50 954	6.9%	2	10.3	12.4	14.5	14.9	*16.1*	13.6	8.7	5.1	2.9	1.4	100	45.4
61 086	8.3%	3	6.8	8.4	11.8	16.7	*19.2*	15.6	11.1	5.6	3.4	1.6	100	51.5
68 311	9.3%	4	4.8	6.0	9.0	*24.0*	21.6	15.0	9.9	5.3	2.9	1.6	100	60.5
85 100	11.5%	5	3.2	4.1	5.9	9.4	23.1	*24.6*	15.9	8.3	3.7	1.9	100	63.5
92 512	12.5%	6	2.0	2.5	3.3	3.3	7.7	27.9	*29.3*	15.1	5.8	3.1	100	72.3
95 860	13.0%	7	1.2	1.5	1.9	1.6	2.7	6.9	30.2	*36.3*	13.7	4.0	100	80.2
95 297	12.9%	8	0.9	1.0	1.1	0.9	1.2	2.4	7.6	*40*	37.0	7.9	100	84.9
86 509	11.7%	9	0.9	0.8	1.1	0.8	1.0	1.7	3.3	9.5	*48.3*	32.6	100	90.4
73 266	9.9%	10	1.0	0.6	1.0	0.8	0.9	1.3	1.9	3.4	11.4	*77.7*	100	92.6
737 891	100%													

Panel C: Sub-sample with control variables (transition probabilities from generalized ordered logit model)

Origin 2008		Destination 2011											
N	%	DECILE	1	2	3	4	5	6	7	8	9	10	Total	Total 3
28 996	3.9%	1	*14.8*	14.8	14.3	13.6	12.9	11.3	7.2	4.7	3.2	3.2	100	43.9
50 954	6.9%	2	10.3	12.4	14.4	14.8	*16.3*	13.7	8.7	5.1	2.8	1.4	100	45.5
61 086	8.3%	3	6.8	8.4	11.8	16.4	*19.2*	15.7	11.1	5.7	3.3	1.5	100	51.3
68 311	9.3%	4	4.8	6.0	9.1	*23.5*	21.6	15.2	10.0	5.4	2.8	1.6	100	60.3
85 100	11.5%	5	3.2	4.1	5.9	9.4	22.8	*24.7*	16.1	8.3	3.7	1.9	100	63.6
92 512	12.5%	6	1.9	2.4	3.2	3.6	7.8	27.5	*29.4*	15.2	5.9	3.1	100	72.1
95 860	13.0%	7	1.2	1.4	1.9	1.8	2.8	7.0	29.8	*36.3*	13.9	4.0	100	80.0
95 297	12.9%	8	0.8	0.9	1.1	1.0	1.3	2.5	7.7	*39.7*	37.0	8.0	100	84.7
86 509	11.7%	9	0.8	0.7	0.9	0.9	1.1	1.7	3.4	9.5	*48.0*	32.8	100	90.3
73 266	9.9%	10	0.9	0.5	0.9	0.8	0.9	1.3	2.0	3.6	11.5	*77.7*	100	92.8
737 891	100%													

Notes: This table reports mean values of transition probabilities from positions in the income distribution in 2008 to decile positions in 2011. Deciles are computed on the entire tax filing population but transition probabilities are computed for survivors in 2011. In models with control variables, predicted probabilities are conditioned by previous position in income distribution, birth region, age, gender, marital status, and education. The most important probability by decile is in italic and in blue. The sum of the three most important probabilities is in column 'Total 3'.

Source: Author's calculation.

Table A2.7: Income mobility in Ecuador, relative to the tax population, transitions between income deciles 2008– 2011, % of net deciles members

	Destination 2011										
Origin 2008	**Decile 1**	**Decile 2**	**Decile 3**	**Decile 4**	**Decile 5**	**Decile 6**	**Decile 7**	**Decile 8**	**Decile 9**	**Decile 10**	**Total**
Decile 1	**30.4**	19.3	13.5	9.9	6.8	5.1	4.1	3.1	3.3	4.4	100
Decile 2	21.2	**21.5**	19.2	14.2	9.4	5.9	3.5	2.2	1.7	1.2	100
Decile 3	13.4	25.3	**22.2**	15.1	9.2	5.9	3.7	2.3	1.7	1.2	100
Decile 4	10	13.9	24.2	**20.8**	12.7	8.2	4.4	2.7	1.9	1.3	100
Decile 5	6.8	6.9	10.9	22.8	**21.8**	14.3	7.7	4	2.9	1.8	100
Decile 6	4.6	4	3.8	9.3	25.9	**25.4**	14.0	6.5	4	2.6	100
Decile 7	3.1	2.5	2	2.9	7	21.2	**31.7**	20.2	6.3	3.1	100
Decile 8	2.9	2.0	1.4	1.9	3.1	7.6	22	**32.6**	21.1	5.4	100
Decile 9	3.3	2.1	1.3	1.6	2.3	4.1	7	19.8	**39.5**	19.0	100
Decile 10	4.3	2.5	1.4	1.5	1.8	2.4	3.1	5.5	17.5	**60.1**	100
Total	100	100	100	100	100	100	100	100	100	100	

Note: This table shows income mobility in Ecuador from 2008 to 2011. Income mobility is relative to the panel population.

Source: Author's calculation based on income tax returns statistics.

Table A2.8: Downward and upward movements of at least ten centiles (Logit multinomial)

	(1)		(2)		(3)		(4)		(5)		(6)	
	upward	downward	upward	downward	upward	downward	upward	downward	upward	downward	upward	downward
Dec1	3.053*	na	2.758*	na	2.438*	na	1.144*	na	0.849*	na	0.635*	Na
	(0.023)		(0.028)		(0.039)		(0.031)		(0.024)		(0.020)	
Dec2	2.484*	0.155*	2.247*	0.145*	2.155*	0.133*	0.997	0.135*	0.742*	0.130*	0.555*	0.113*
	(0.017)	(0.002)	(0.021)	(0.003)	(0.029)	(0.004)	(0.026)	(0.004)	(0.020)	(0.004)	(0.016)	(0.004)
Dec3	2.182*	0.362*	1.973*	0.338*	2.067*	0.345*	0.961	0.365*	0.710*	0.352*	0.532*	0.307*
	(0.014)	(0.004)	(0.018)	(0.005)	(0.027)	(0.007)	(0.025)	(0.010)	(0.019)	(0.010)	(0.015)	(0.010)
Dec4	0.969*	0.332*	0.877*	0.311*	0.830*	0.298*	0.394*	0.329*	0.290*	0.319*	0.217*	0.279*
	(0.006)	(0.003)	(0.008)	(0.004)	(0.010)	(0.005)	(0.010)	(0.008)	(0.008)	(0.008)	(0.006)	(0.008)
Dec5	0.862*	0.376*	0.778*	0.352*	0.717*	0.310*	0.342*	0.350*	0.237*	0.345*	0.176*	0.299*
	(0.005)	(0.003)	(0.007)	(0.004)	(0.008)	(0.005)	(0.009)	(0.009)	(0.006)	(0.009)	(0.005)	(0.009)
Dec6	0.673*	0.287*	0.608*	0.270*	0.537*	0.221*	0.270*	0.263*	0.172*	0.264*	0.127*	0.228*
	(0.004)	(0.002)	(0.005)	(0.003)	(0.006)	(0.004)	(0.007)	(0.006)	(0.004)	(0.007)	(0.004)	(0.007)
Dec7	0.556*	0.217*	0.505*	0.205*	0.409*	0.156*	0.207*	0.187*	0.125*	0.191*	0.092*	0.165*
	(0.003)	(0.002)	(0.004)	(0.002)	(0.005)	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
Dec8	0.314*	0.176*	0.285*	0.167*	0.192*	0.116*	0.099*	0.144*	0.057*	0.150*	0.042*	0.129*
	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)	(0.004)	(0.002)	(0.004)	(0.001)	(0.004)
Dec9	0.093*	0.221*	0.084*	0.209*	0.059*	0.131*	0.033*	0.176*	0.019*	0.185*	0.014*	0.160*
	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)	(0.004)	(0.001)	(0.005)	(0.000)	(0.005)
Dec10	na	0.250*	na	0.234*	na	0.130*	na	0.181*	na	0.191*	na	0.166*
		(0.002)		(0.003)		(0.002)		(0.004)		(0.005)		(0.005)
Pichincha			1.074*	1.121*	1.215*	1.246*	1.185*	1.210*	1.117*	1.238*	1.118*	1.238*
			(0.009)	(0.012)	(0.013)	(0.018)	(0.013)	(0.018)	(0.012)	(0.018)	(0.012)	(0.018)
Guayas			1.227*	1.130*	1.474*	1.301*	1.436*	1.255*	1.351*	1.275*	1.346*	1.273*
			(0.010)	(0.012)	(0.017)	(0.020)	(0.017)	(0.019)	(0.016)	(0.020)	(0.016)	(0.020)
Coast			1.030*	1.087*	1.046*	1.112*	1.066*	1.133*	1.053*	1.133*	1.045*	1.128*
			(0.009)	(0.012)	(0.012)	(0.018)	(0.013)	(0.018)	(0.013)	(0.018)	(0.013)	(0.018)
Centre			1.119*	0.934*	1.107*	0.897*	1.130*	0.910*	1.077*	0.923*	1.073*	0.922*
			(0.010)	(0.011)	(0.013)	(0.015)	(0.014)	(0.015)	(0.013)	(0.015)	(0.013)	(0.015)
South			1.116*	0.979	1.241*	0.988	1.291*	1.012	1.241*	1.032	1.234*	1.030
			(0.011)	(0.012)	(0.016)	(0.017)	(0.017)	(0.018)	(0.016)	(0.018)	(0.016)	(0.018)
Age 19							1.602*	1.310*	1.303*	1.367*	1.348*	1.386*
							(0.047)	(0.047)	(0.039)	(0.050)	(0.040)	(0.051)
Age 20–29							2.555*	1.124*	2.007*	1.183*	2.061*	1.193*
							(0.058)	(0.022)	(0.046)	(0.024)	(0.048)	(0.024)

Table A2.8: (cont.)

	(1)		(2)		(3)		(4)		(5)		(6)	
	upward	downward	upward	downward	upward	downward	upward	downward	upward	downward	upward	downward
Age 30–39							2.173*	0.823*	1.770*	0.862*	1.812*	0.868*
							(0.049)	(0.016)	(0.041)	(0.017)	(0.042)	(0.017)
Age 40–49							1.608*	0.634*	1.338*	0.663*	1.364*	0.666*
							(0.037)	(0.013)	(0.031)	(0.014)	(0.032)	(0.014)
Age 50–59							1.073*	0.524*	0.965	0.540*	0.975	0.541*
							(0.027)	(0.012)	(0.024)	(0.012)	(0.024)	(0.012)
Gender									1.199*	1.118*	1.667*	1.319*
									(0.008)	(0.009)	(0.027)	(0.027)
Married									1.044*	0.964*		
									(0.007)	(0.008)		
Education									2.015*	0.845*		
									(0.015)	(0.008)		
Marriedman											1.090*	0.982
											(0.009)	(0.010)
Marriedwoman											0.974	0.937*
											(0.010)	(0.013)
Educman											1.809*	0.802*
											(0.015)	(0.009)
Aducwoman											2.874*	1.009
											(0.043)	(0.020)
Obs.	1,408,497		1,408,497		737,891		737,891		737,891		737,891	
Chi2 statistic	430,313.03		430,980.62		268,284.33		271,640.32		277,792.66		278,645.23	
Log pseudolikelihood	-1,174,173.92		-1,173,263.96		-587,039.69		-581,542.11		-575,765.08		-575,336.37	

Exponentiated coefficients * p<0.01

Notes*:* Estimates give the probability of “strong upward mobility” or “strong downward mobility” relative to the base category “weak or no movement”.

na: coefficients non available because they cannot be estimated (no upward movement for dec10 and no downward movement for dec1)

Omitted categories are north, age60.

Source: Author's calculation.

Table A2.9: Factors associated with income mobility in Ecuador, 2008–2011

	(1)		(2)		(3)		(4)		(5)		(6)	
	dcent	centile effect	dcent	centile effect	dcent	centile effect	dcent	centile effect	dcent	centile effect	dcent	centile effect
Dec1	0.981*	45	0.969*	45	0.725*	35	0.657*	32	0.573*	28	0.534*	26
	(0.002)		(0.002)		(0.003)		(0.004)		(0.004)		(0.005)	
Dec2	0.517*	25	0.507*	25	0.513*	25	0.441*	22	0.359*	18	0.320*	16
	(0.002)		(0.002)		(0.002)		(0.004)		(0.004)		(0.004)	
Dec3	0.373*	18	0.363*	18	0.376*	19	0.297*	15	0.216*	11	0.177*	9
	(0.001)		(0.002)		(0.002)		(0.004)		(0.004)		(0.004)	
Dec4	0.185*	9	0.174*	9	0.172*	9	0.089*	4	0.012*	1	-0.026*	-1
	(0.001)		(0.002)		(0.002)		(0.004)		(0.004)		(0.004)	
Dec5	0.117*	6	0.105*	5	0.104*	5	0.018*	1	-0.073*	-4	-0.112*	-6
	(0.001)		(0.002)		(0.002)		(0.003)		(0.004)		(0.004)	
Dec6	0.080*	4	0.066*	3	0.071*	4	-0.016*	-1	-0.126*	-6	-0.167*	-8
	(0.001)		(0.002)		(0.002)		(0.003)		(0.004)		(0.004)	
Dec7	0.059*	3	0.045*	2	0.053*	3	-0.034*	-2	-0.160*	-8	-0.201*	-10
	(0.001)		(0.002)		(0.002)		(0.003)		(0.004)		(0.004)	
Dec8	0.016*	1	0.000	0	0.013*	1	-0.075*	-4	-0.214*	-11	-0.254*	-13
	(0.001)		(0.002)		(0.002)		(0.003)		(0.004)		(0.004)	
Dec9	-0.095*	-5	-0.110*	-5	-0.063*	-3	-0.150*	-7	-0.295*	-15	-0.335*	-17
	(0.001)		(0.002)		(0.002)		(0.003)		(0.004)		(0.004)	
Dec10	-0.250*	-12	-0.265*	-13	-0.140*	-7	-0.224*	-11	-0.380*	-19	-0.419*	-21
	(0.001)		(0.002)		(0.002)		(0.003)		(0.004)		(0.004)	
Pichincha			0.007*	0	0.016*	1	0.017*	1	0.004	0	0.004	0
			(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
Guayas			0.016*	1	0.024*	1	0.025*	1	0.014*	1	0.013*	1
			(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
Coast			-0.020*	-1	-0.015*	-1	-0.016*	-1	-0.016*	-1	-0.017*	-1
			(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
Centre			0.045*	2	0.032*	2	0.032*	2	0.022*	1	0.022*	1
			(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
South			0.039*	2	0.039*	2	0.041*	2	0.031*	2	0.030*	1
			(0.002)		(0.002)		(0.002)		(0.002)		(0.002)	
Age 19							-0.075*	-4	-0.108*	-5	-0.104*	-5
							(0.005)		(0.005)		(0.005)	
Age20–29							0.084*	4	0.041*	2	0.044*	2
							(0.003)		(0.003)		(0.003)	

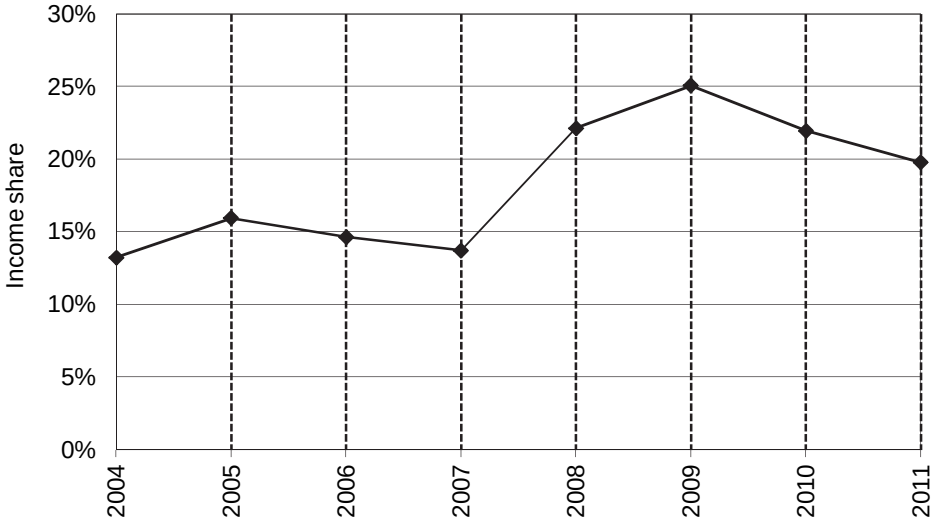
Table A2.9: (cont.)

	(1)		(2)		(3)		(4)		(5)		(6)	
	dcent	centile effect	dcent	centile effect	dcent	centile effect	dcent	centile effect	dcent	centile effect	dcent	centile effect
Age 30–39							0.097*	5	0.061*	3	0.063*	3
							(0.003)		(0.003)		(0.003)	
Age 40–49							0.092*	5	0.060*	3	0.061*	3
							(0.003)		(0.003)		(0.003)	
Age 50–59							0.086*	4	0.069*	3	0.069*	3
							(0.003)		(0.003)		(0.003)	
Gender									0.022*	1	0.067*	3
									(0.001)		(0.003)	
Married									0.018*	1		
									(0.001)			
Education									0.171*	9		
									(0.001)			
Marriedman											0.025*	1
											(0.001)	
Marriedwoman											0.006*	0
											(0.002)	
Educman											0.157*	8
											(0.001)	
Educwoman											0.221*	11
											(0.003)	
Obs.	1,408,497		1408497		737 891		737 891		737 891		737 891	
F-statistic-full	54200.9		36331.2		17541.5		13373.3		12751.5		11764.0	
R2	0.278		0.279		0.263		0.266		0.284		0.285	
Root MSE	0.534		0.533		0.417		0.416		0.411		0.410	

Note: * p<0.01. Omitted categories are north, age60.

Source: Author's calculation.

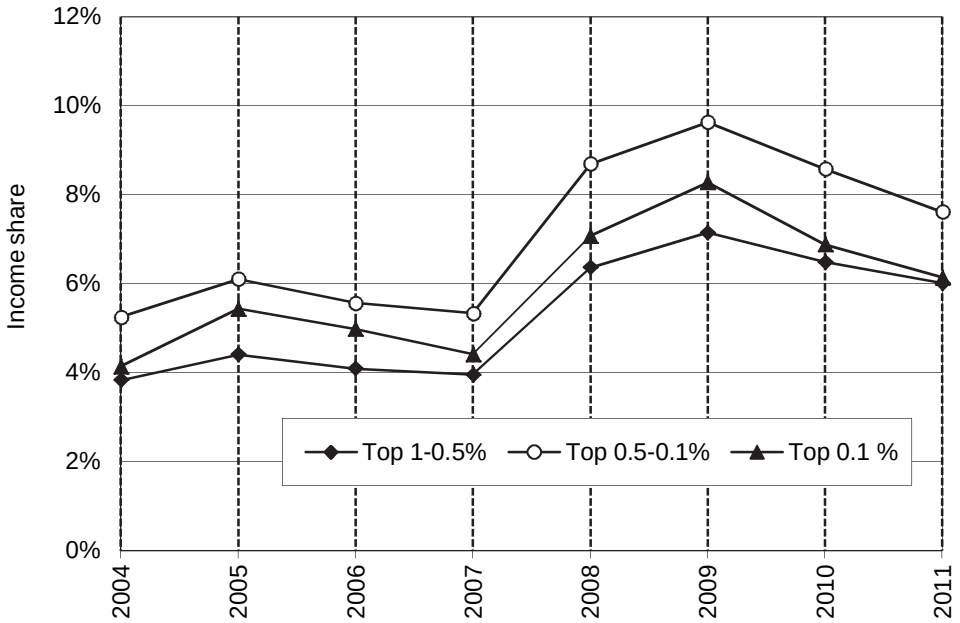
Figure A2.1: Top 1% income share in Ecuador, 2004–11



Note: Figure A2.1 displays the top 1% income share in Ecuador from 2004 to 2011. Estimates are based on tax returns statistics. External controls for total income and population are from household surveys. Income definition is pre-tax.

Source: Author's calculation.

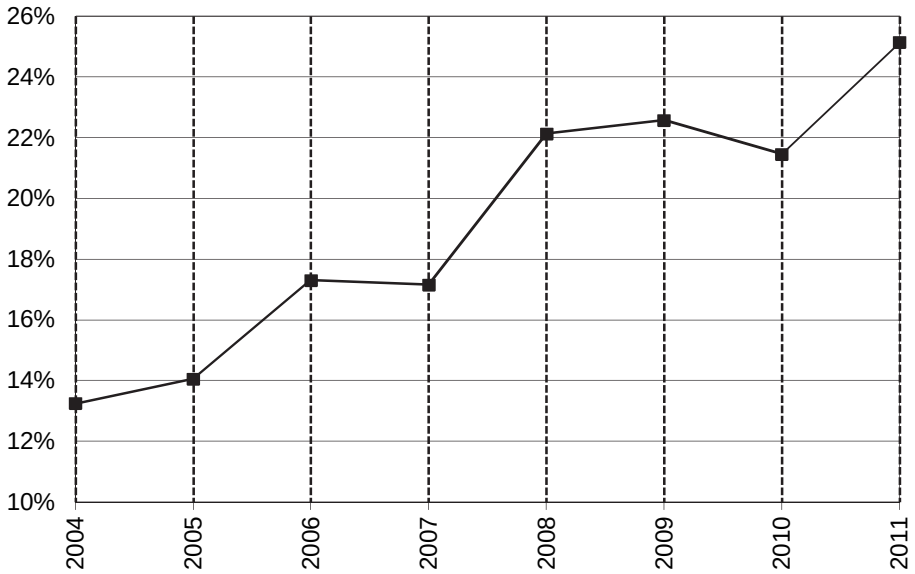
Figure A2.2: Finer fractiles of top income shares in Ecuador, 2004–11



Note: Figure A2.2 displays finer fractiles of top income shares in Ecuador from 2004 to 2011. Estimates are based on tax returns statistics. External controls for total income and population are from household surveys. Income definition is pre-tax.

Source: Author's calculation.

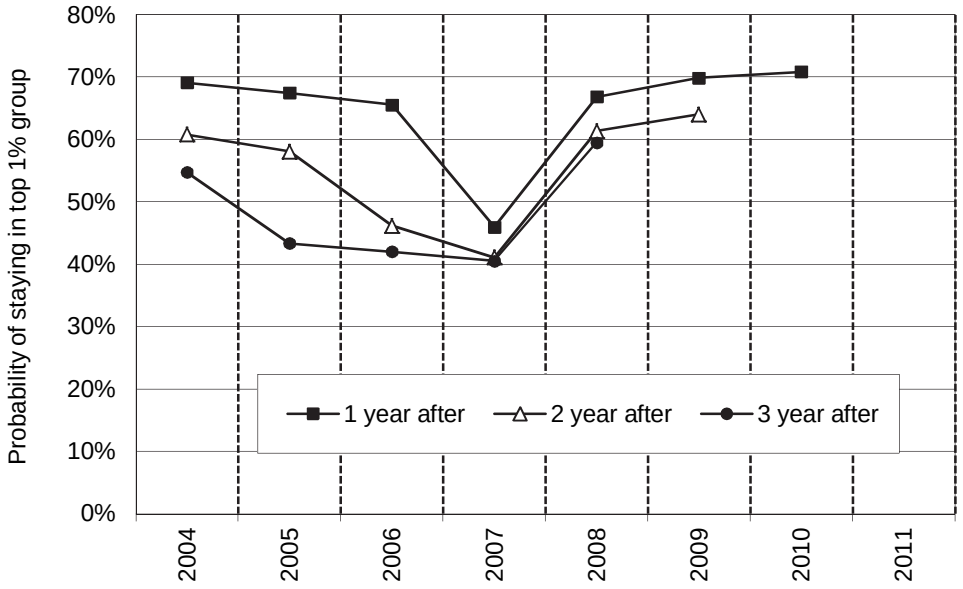
Figure A2.3: Individual income tax filers as percentage of tax units, adults aged 20 and more. Ecuador 2004–11



Note: Figure A2.3 displays the evolution of individual income tax filers as percentage of adult population aged 20 and more, from 2004 to 2011. Tax filers data are from tax returns statistics and adult population data from ENEMDU Survey.

Source: Author's calculation.

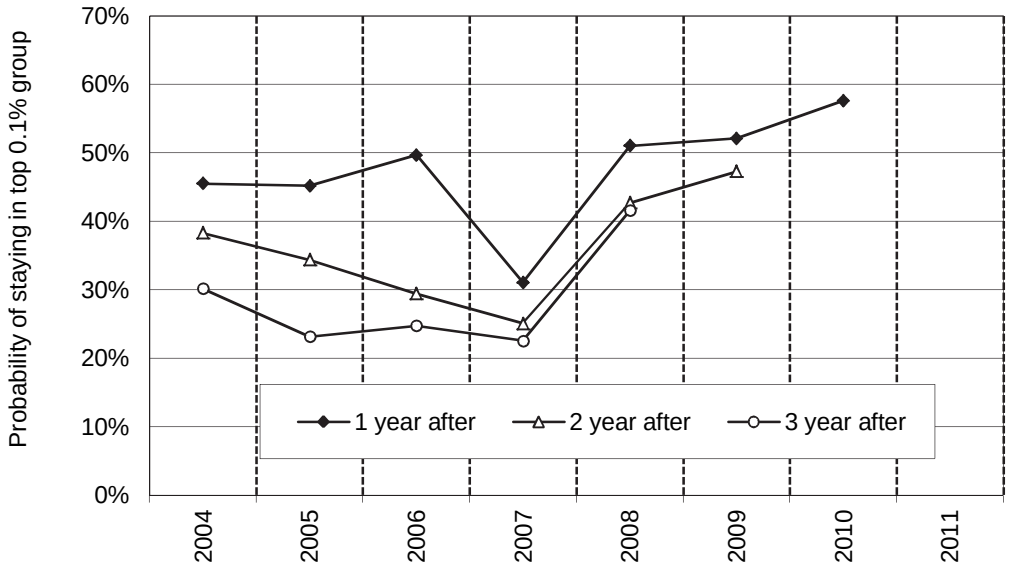
Figure A2.4: Probability of staying in top 1% group - one, two and three years after Ecuador 2004–11



Note: Probability of staying in top income groups. Based on tax return statistics.

Source: Author's calculation.

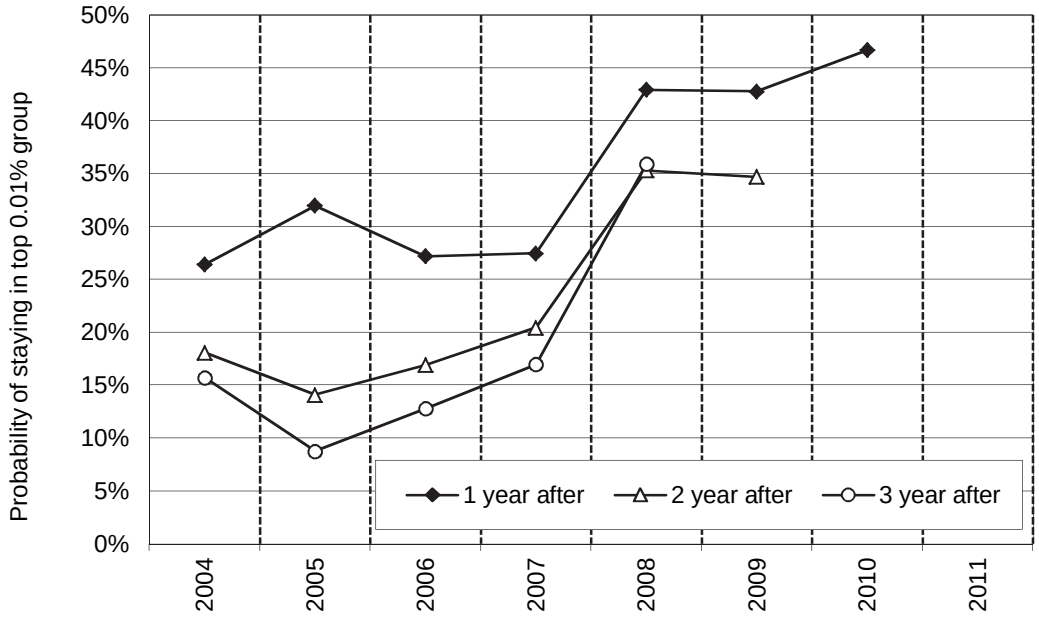
Figure A2.5: Probability of staying in top 0.1% group—one, two, and three years after Ecuador 2004–11



Note: Probability of staying in top income groups. Based on tax return statistics.

Source: Author's calculation.

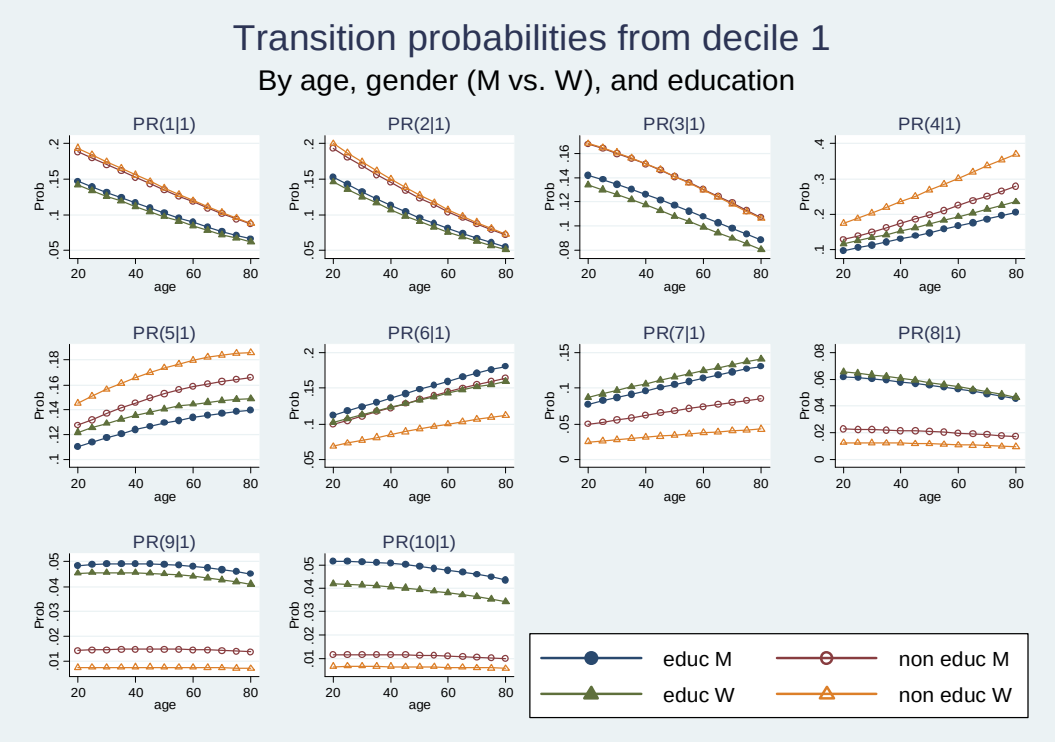
Figure A2.6: Probability of staying in top 0.01% group - one, two and three years after Ecuador 2004–11



Note: Probability of staying in top income groups. Based on tax return statistics.

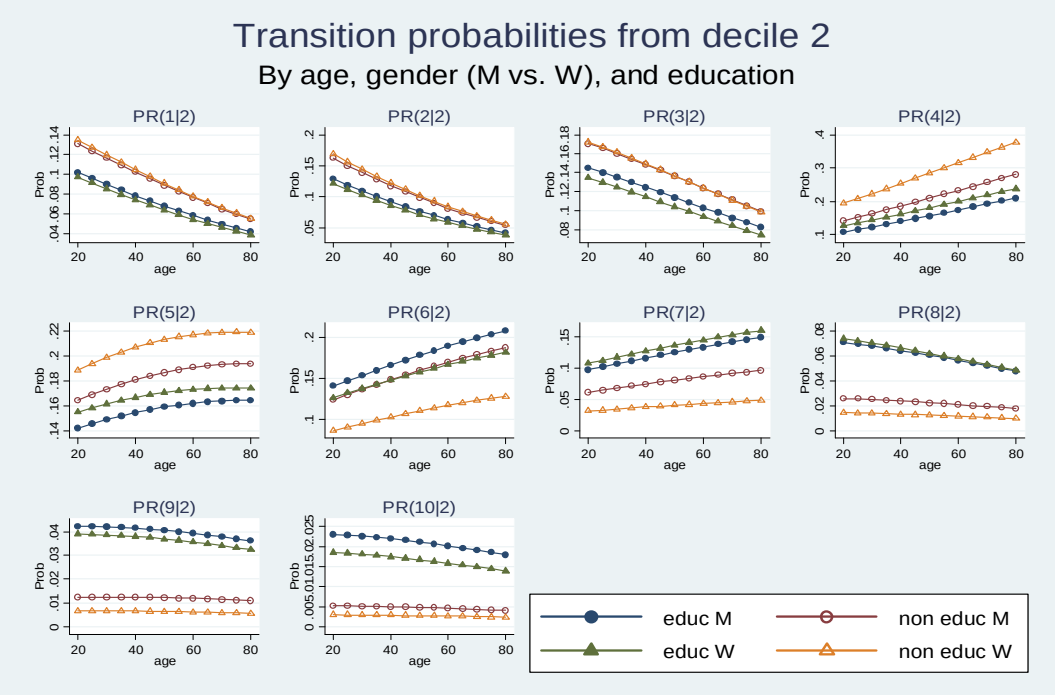
Source: Author's calculation.

Figure A2.7: Transition probabilities from decile 1



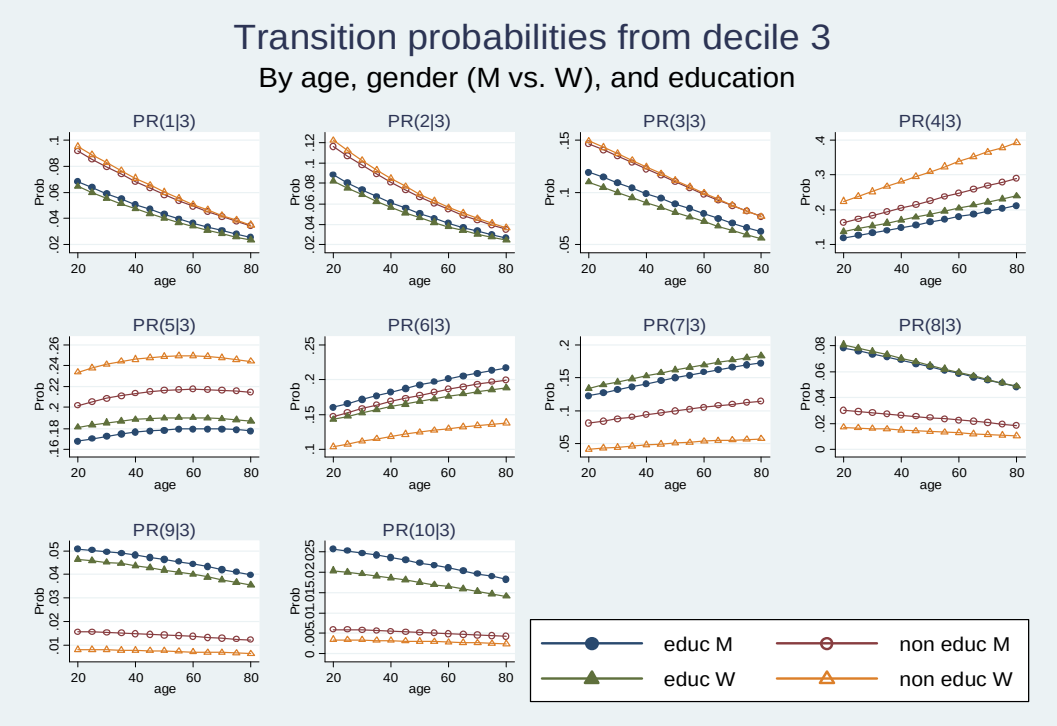
Source: Author's calculation.

Figure A2.8: Transition probabilities from decile 2



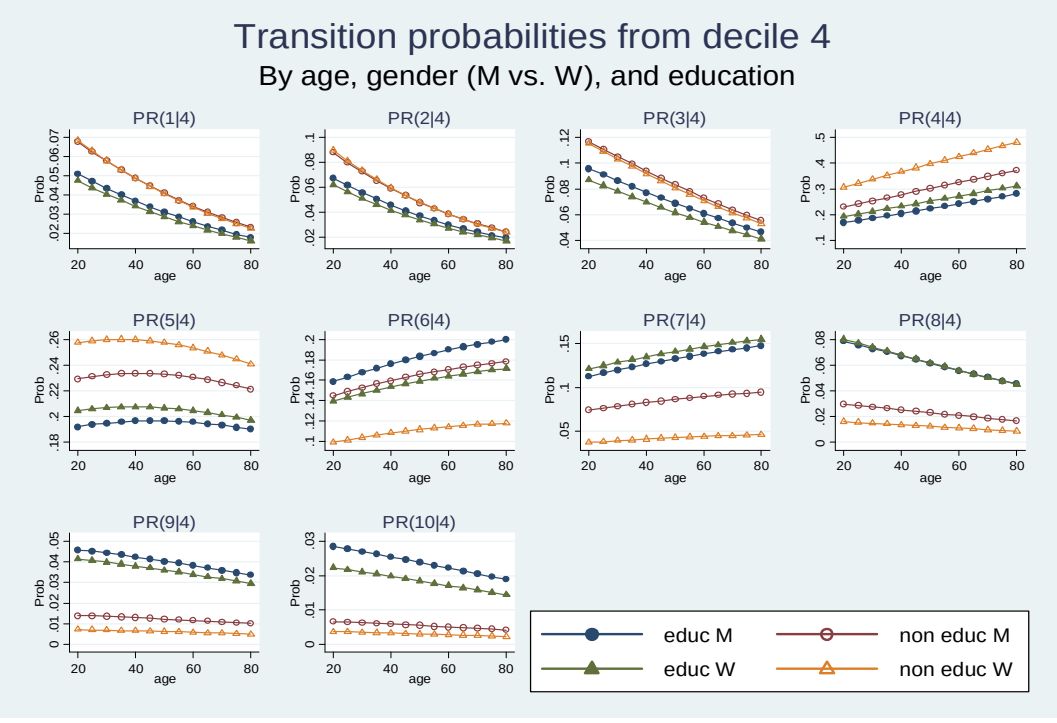
Source: Author's calculation.

Figure A2.9: Transition probabilities from decile 3



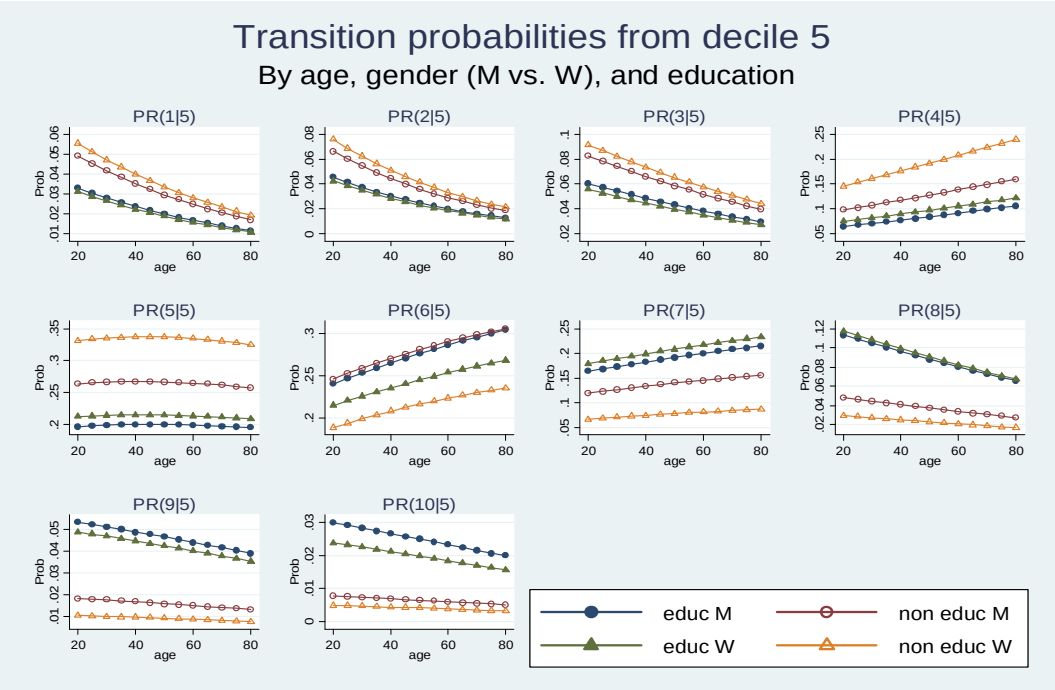
Source: Author's calculation.

Figure A2.10: Transition probabilities from decile 4



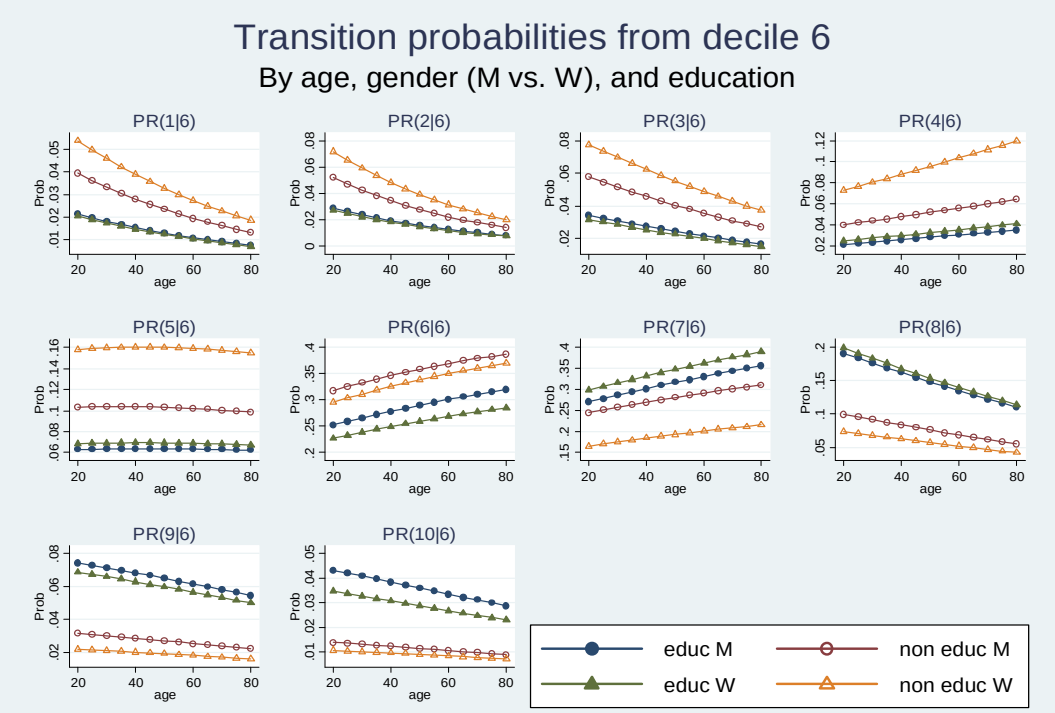
Source: Author's calculation.

Figure A2.11: Transition probabilities from decile 5



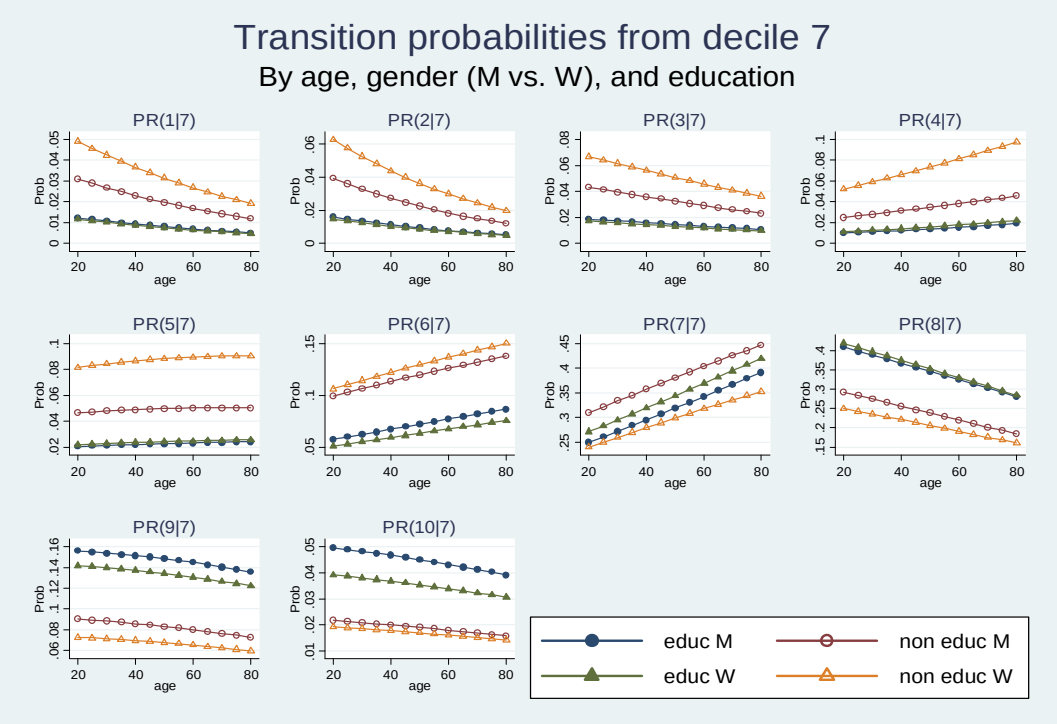
Source: Author's calculation.

Figure A2.12: Transition probabilities from decile 6



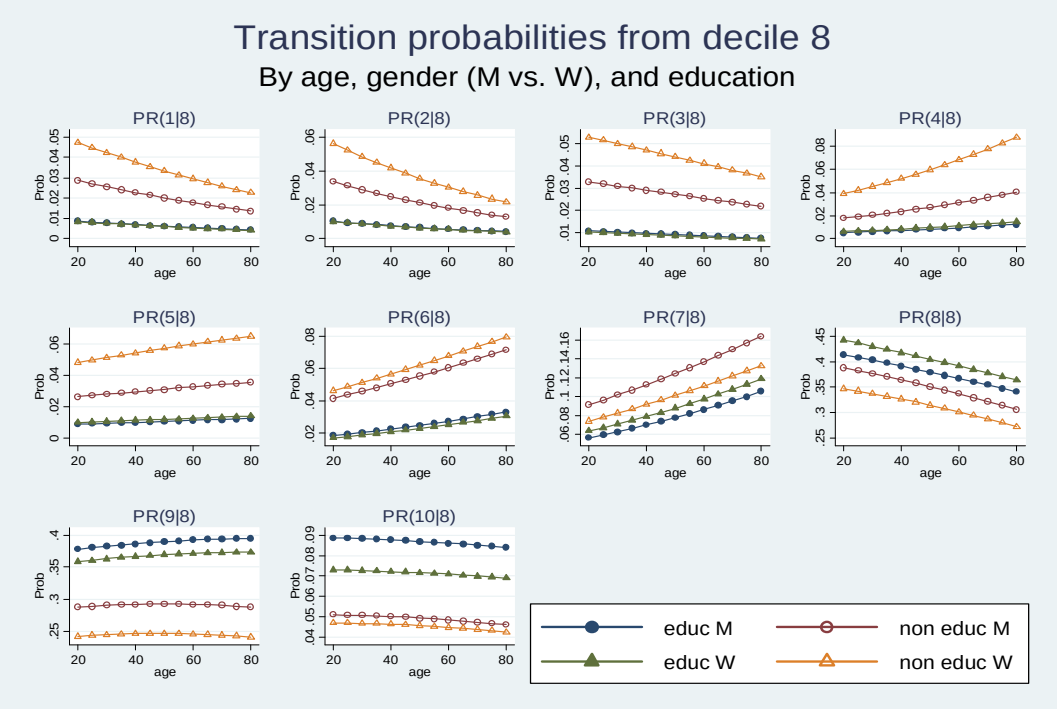
Source: Author's calculation.

Figure A2.13: Transition probabilities from decile 7



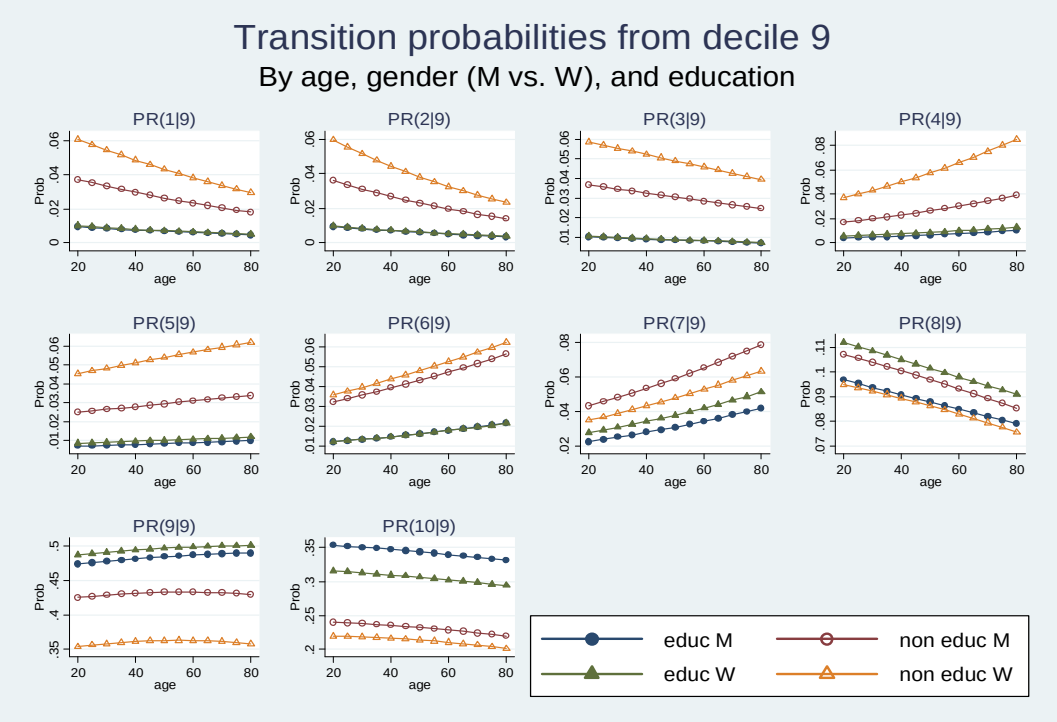
Source: Author's calculation.

Figure A2.14: Transition probabilities from decile 8



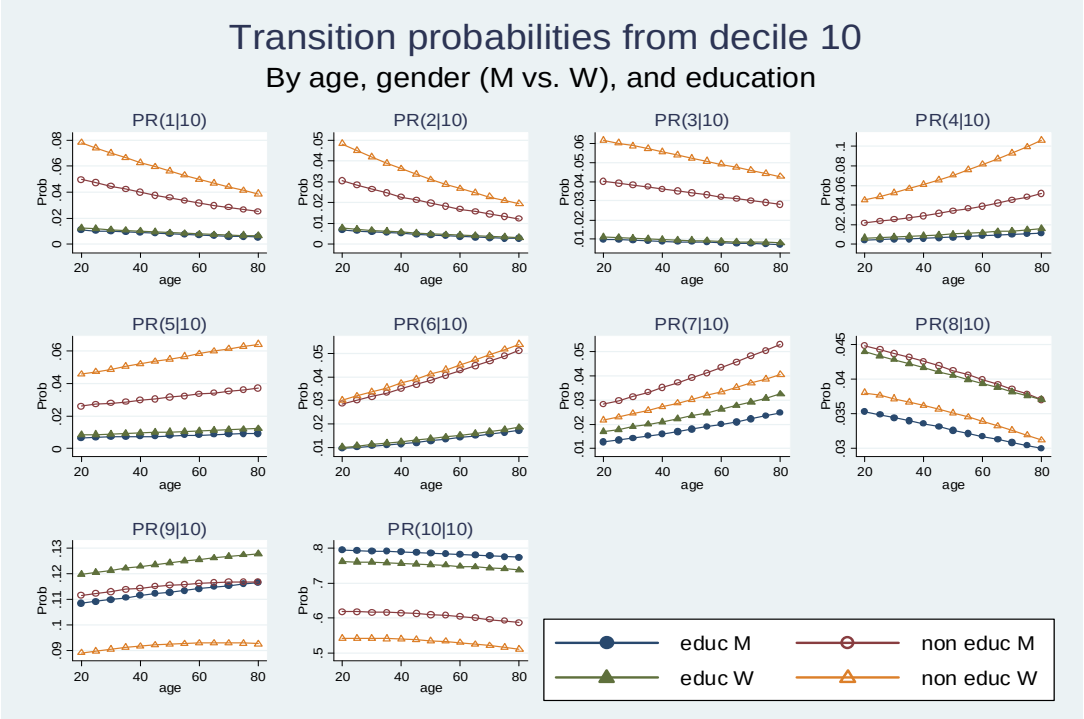
Source: Author's calculation.

Figure A2.15: Transition probabilities from decile 9



Source: Author's calculation.

Figure A2.16: Transition probabilities from decile 10



Source: Author's calculation.