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Abstract

There is an increasing literature that discusses how to measure the middle class. Some approaches are based on an arbitrary definition such as income quartiles or the poverty line. Recently, Foster and Wolfson developed a methodology which lacks of arbitrariness that enables us to compare the middle class of two different income distributions. We apply this new tool jointly with a complementary method –relative distribution approach- to household income data in 1994-2004 and 2004-2010, to analyze the evolution of the middle class and polarization in Uruguay. During the first period, which is characterized by an increasing income inequality, we find that the middle class declined and income polarization increased. In the second one, where the Uruguayan economy experienced a recovery from the downturn suffered in 2002, we find that the middle class rose and polarization decreased. However, this last result is attenuated when we do not consider the household income imputation because of the new health system implemented in 2008.

Keywords: income polarization, middle class, inequality, social policies, bipolarization

JEL classifications: D3, D6, I3

Resumen

Existe una creciente literatura que discute como medir la clase media. Algunos enfoques se basan en una definición arbitraria como quintiles de ingreso o la línea de pobreza. Recientemente, Foster and Wolfson desarrollaron un metodología no arbitaria que nos permite comparar la clase media de dos diferentes distribuciones de ingreso. Aplicamos dicha nueva herramienta junto al método complementario -enfoque de distribución relativa- a datos de ingreso de hogares en 1994-2004 y 2004-2009, para analizar la evolución de la clase media y polarización en Uruguay. En el primer período que se caracteriza por creciente inequidad encontramos que la clase media cae y la polarización aumenta. En el segundo período las conclusiones se revierten. Sin embargo, este último resultado se atenua cuando no consideramos la imputación en el ingreso de los hogares por la nueva reforma de salud implementada en 2008.

Palabras claves: clase media, polarization, social policies, bipolarization, inequidad

Códigos JEL: D3, D6 ,I3

1 Introduction

Previous research observes a tendency toward income inequality during the nineties in almost all Latin American and Caribbean (LAC) countries (IADB, 1998 or Bourguignon and Morrison, 2002). Uruguay is not the exception and during the nineties we observe an increase in income inequality (Amarante and Vigorito, 2006). In addition, there is a common perception that because of the vigorous economic growth in the last years the middle class in LAC countries is declining. However, this fact is rarely confirmed in research documents. From an economic and social perspective, the middle class could play an important role in the development of a democratic country since it contributes with a significant share of the labor force, and therefore is closely related with the country´s output and usually represents the main source of tax revenue.[1] Moreover, an increase in the middle class because of the reduction of the lower and upper class could enhance the positive externalities mentioned above, that is, to reduce income inequality and the antagonism between classes which is an important source of social tensions.

However, an opening question is, what is the appropriate definition of the middle class? First of all, the middle class in economics is usually based on the distribution of an indicator of social welfare such as household income (the most commonly used), household expenditure, labor status, education attainment, etc. Consequently the definition of the middle class is related to the distribution of one variable. Therefore, the main problem is to arbitrary identify which range of the income distribution represents the middle class. The literature is not unanimous in this issue (see Foster and Wolfson, 2009 for a further discussion in developed countries and Cruces, *et al.*, 2010 for developing countries) and different definitions could lead to diverse and uncomparable results. In order to analyze the evolution of the middle class, Foster and Wolfson (2009) developed a methodology which lacks of arbitrariness that it is based on the concept of "partial orderings" and first (and second) degree stochastic dominance. This method yield two curves (one for each population we would like to compare)

[1] In Uruguay, considering the 2001 tributary system, Grau and Lagomarsino, 2002 show that the first two income quantiles contribute with 22% of the tax revenue, while the top two income quantiles contribute with 18%. The middle income quantiles (3 to 6) contribution is 60%.

that enables us to unambiguously determine which distribution concentrates more population around its median.

A second concept related to middle class and income inequality is income polarization. Esteban and Ray (1994) employ two elements to define polarization: 1) the sense of "identification" with a group who shares common features within it; 2) the level of "alienation" between the identified groups. Thus, a polarized society is one which could be divided into few groups who share a similar level of income and there is a considerable distance (in terms of income) between each group. Income polarization and income inequality could go in the same direction or in the opposite one depending on the variation of the shape of the income distribution, which could be affected by several factors (e.g. tax reforms, social policies). Duclos *et al.* (2004) derive a polarization index that is related with the Gini coefficient. Using this methodology for LAC countries in the period 1989-2004, Gasparini *et al.* (2008) find that, overall, income polarization increased and in the case of Uruguay it increased sharply. This fact represents a relevant issue from a social point of view since a high level of polarization is positively correlated with a high level of social conflict.

In generally, the society could be split into three classes, lower, middle and upper based on income levels. Sometimes, a declining middle class could be an indicator of increasing polarization. For instance, polarization could increase in the case of bipolarization, when we observe higher mass in the lower and upper tails of the income distribution than in the middle. On the other hand, the widening of the gap between the lower and upper class could result in higher polarization (via "alienation" according to the terminology of Esteban and Ray) which do not necessary imply a reduction in the middle class. Foster and Wolfson (2009) formalize those ideas using a similar methodology as the one employed to measure the middle class. In their case, the output are two different polarization curves that enable us to capture the two aspect of polarization: 1) the "first degree" polarization curve, which is associated with the concept of "increasing spread"; and 2) the "second degree" polarization curve, which is related to the "increased bipolarity" concept. In addition, they propose an index to measure bipolarization which is closely related to the Gini index.

All the prior measures are useful in characterizing some sort of stylized facts of the overall

income distribution at one period, which are summarized into an index. By comparing this index in two different periods we would be able to analyze how does this indicator evolve. However, we would like to go one step further and compare the entire income distribution in two different points in time to analyze the evolution of the whole distribution. Handcock and Morris (1998, 1999) provide the theoretical framework for the relative distribution approach which enable us to compare two different distributions. Moreover, this non-parametric methodology gives us the tools to separately estimate the effects attributable to changes in the shape of the income distribution and those which come from changes in the location of the income distribution.

In recent years, different kinds of "re-distributive" policies, which potentially could have an impact on the income distribution have been introduced. For instance, in 2005 a conditional cash transfer program was launched [2] and the real minimum wage grew 63%. In addition, in 2007 a tax reform was implemented. Rodriguez and Perazzo (2007) conclude that the changes in sale taxes (VAT) favors household in the first and last quantiles of the income distribution. Regarding the new personal income tax, Barriex and Roca (2007) find that the Gini index decreases 0.022 points. A shortcoming of these studies of the income distribution implications of the tax reform is the lack of general equilibrium effects. However, we expect an impact of the "re-distributive" policies on the income distribution.

Additionally, between 2005 and 2010 the Uruguayan economy grew around 30% in real terms (5% yearly). The relationship in the literature, between inequality and economic growth remains open (Aghion, Caroli and Gracia-Penalosa, 1999). For instance, growth could lead to wage inequality by spreading the gap across educational cohorts. Nevertheless, the new theoretical framework does not imply a trade-off between growth and inequality. In the last years, we observe that income inequality fluctuates without a trend. Therefore, if growth is positively correlated with inequality then policy efforts could slow down inequality but not reduce it.

The aim of this paper is to define and characterize the middle class, as well as, to analyze the evolution of income polarization and the middle class in two different periods:

[2] See Borraz and González (2009).

1)1994-2004, in where inequality raised dramatically; and 2) 2004-2010, in where inequality remains stable and the Uruguayan economy experienced a recovery from the downturn suffered in 2001. We use the Uruguayan National Household Survey to apply different and complementary methodologies. In order to define the middle class, we follow Esteban *et al.* (1999) and we estimate multinomial (and ordered) logit model to disentangle some features of the middle class. To quantify polarization and bipolarization we compute the polarization index developed by Duclos et al. (2004) and the bipolarization index derived by Foster and Wolfson (2009). We also use the Foster and Wolfson´s curves to analyze the evolution of the middle class. Finally, following Handcock and Morris (1998, 1999) we apply the relative distribution approach.

Several issues motivate us to carry out this research: 1) apply these new tools to analyze the Uruguayan case and contribute with new evidence for the discussion on this topic; 2) analyze whether the tendency toward income polarization and inequality observed during the nineties is reversed in recent years; and 3) analyze how sensitive are the results to some component of the household income, specifically, if we do not consider the imputed income because of the new medical system (NMS) implemented in Uruguay in 2008. We conclude that the middle class declined and income polarization increased between 1994 and 2004 and decreased between 2010 and 2004. However, this last result is attenuated when we do not consider the household income imputation because of the new health system.

2 Measuring the Middle Class

One important issue about the concept of the middle class is its lack of consensus, principally because different definitions lead to dissimilar results. Using the income distribution function, our main concern is to define at which specific income range the middle class belongs to. For instance, let m be the middle of the income distribution measured by the median. We could consider that those households with an income between m - ε and $m + \varepsilon$ belong to the

middle class and therefore, the proportion of households between the latter range represent a measure of the middle class size. However, this prior definition depends on the value of ε.In this context, the methodology proposed by Foster and Wolfson (2009) is not subject to a specific income interval and hence it does not suffer from arbitrariness. This approach is derived from the idea of partial ordering and stochastic dominance.

Let F represent an income distribution function in one period. Since different distribution functions might have different medians, we consider a median-normalized F denoted as $\tilde{F}$ to make a robust comparison between two different distributions functions. The middle class index for $\tilde{F}$ given an income range $R = [\underline{\varepsilon}, \bar{\varepsilon}]$ is defined as:

$$M_{\tilde{F}}(R) = M_{\tilde{F}}(\underline{\varepsilon}) + M_{\tilde{F}}(\bar{\varepsilon}) = \left[\tilde{F}(1) - \tilde{F}(\underline{\varepsilon})\right] + \left[\tilde{F}(\bar{\varepsilon}) - \tilde{F}(1)\right] \quad with \quad 0 \leq \underline{\varepsilon} \leq 1 \leq \bar{\varepsilon} \quad (1)$$

where $\tilde{F}(1) = 0.5$ and $M_{\tilde{F}}(\underline{\varepsilon})$ and $M_{\tilde{F}}(\bar{\varepsilon})$ are the "lower middle class" and the "upper middle class", respectively. For example, for the income range $R_1 = [0.5, 1.5]$ we obtain the following middle class index: $M_{\tilde{F}}(R_1) = M_{\tilde{F}}(0.5) + M_{\tilde{F}}(1.5)$. By considering different income ranges, we are able to construct a curve that is not restricted to one particular definition of the middle class: $M_{\tilde{F}}(R_i)$ $with$ $i = 1, ...n$, in where the index i denote the income range and thus, giving the idea that the latter measure support any definition of the middle class.

Thus, considering two distribution functions F and G and using the notion of partial ordering, the following binary relation M can be stated:

$$FMG \iff M_{\tilde{F}}(R_i) \geq M_{\tilde{G}}(R_i) \ \forall \ i = 1, ..., n \ \ and \ \ M_{\tilde{F}}(R_i) > M_{\tilde{G}}(R_i) \ \ for\ some\ i$$

(Proposition 1)

In other words, if Proposition (1) holds "F has an unambiguously larger middle class than G", for any definition of the middle class. This proposition can also be formalized using the notion of stochastic dominance,

$$If \ \ 1)\ \tilde{F}(\varepsilon) \leq \tilde{G}(\varepsilon) \ \forall\ \varepsilon \leq 1 \ \ and \ \ 2)\ \tilde{F}(\varepsilon) \geq \tilde{G}(\varepsilon) \ \forall\ \varepsilon \geq 1 \implies FMG \quad \text{(Proposition 2)}$$

The first condition implies that $\tilde{F}$ stochastically dominates $\tilde{G}$ for all $\varepsilon \leq 1$, while the second one implies the opposite for $\varepsilon \geq 1$. That is, the distribution F acummulate more mass around its median than distribution G, which acummulate more mass in the upper and lower tail. In our case, we estimate three curves, one for the 1994 income distribution, other for the 2004 income distribution and finally one for the 2009 income distribution. After that, we compare 1994 with 2004 and this latter year with 2010. If the estimated curves do not cross at any part in each period, we are able to draw an unambiguous conclusion about the evolution of the middle class during both periods. Otherwise, we only have the information of the different income ranges that support prior definitions.

2.1 Polarization Measures

A declining middle class could be related with a more bipolarized income distribution whenever the middle class reduction occurs jointly with an increase of the lower and upper class. The Foster and Wolfson bipolarization index and polarization curves are based on the idea that movements away from the middle via increased spread or increased extreme's in the income distribution lead to a rise in polarization. Thus, they divide the income distribution in two, forming two income groups one above and one below the median.The approach to derive the first "degree" polarization curve is similar to the one used to measure the middle class, but here the aim is to find out the income interval that includes all the households belonging to a given population range. For example, for a given population range $Q = [\underline{\omega}, \overline{\omega}]$, the distribution F has a certain income range. The greater the income range required to quantify any defined population range the greater the income spread (growth in polarization). Hence, we are interested in measuring income spread as the width of the income range in the distribution F given a population range. Formally,

$$S_F(\omega_i) = \left| \tilde{F}^{-1}(\omega_i) - \tilde{F}^{-1}(0.5) \right| \quad with \quad 0 \leq \omega_i \leq 1 \quad \forall\, i = 1, ..., n \tag{2}$$

Note that in this case i refers to population range. Again, using the notion of partial ordering, the following proposition is derived:

$$FSG \Longleftrightarrow S_F(\omega_i) \geq S_G(\omega_i) \ \forall \ i = 1, ..., n \ \ and \ \ S_F(\omega_i) > S_G(\omega_i) \ \ for \ some \ i$$

(Proposition 3)

This proposition states that for a given population range i the income distribution F reveals a greater income spread than the income distribution G, that is, F has a greater income polarization than G. This results holds for any population range. Furthermore, since a greater income spread implies less proportion of population around the middle, Proposition (3) implies that the income distribution G has a greater middle class than the income distribution F, and therefore G dominates F (GMF). Additionally, Foster and Wolfson construct a second curve called "second-degree" polarization which considers at the same time both sources of polarization: "increased spread" and "increased bipolarity". It is defined as the area under the first degree polarization curve between 0.5 and a population share ω_i:

$$B_F(\omega_i) = \left| \int_{\omega_i}^{0.5} S_F(p) \ dp \right| \quad with \ \ 0 \leq \omega_i \leq 1 \quad \forall \ i = 1, ..., n \tag{3}$$

The second-degree polarization curve is similar to the Lorenz curve which acumulate the population share from the lowest to the highest incomes. This new curve acumulate income spreads from the middle to the top and the bottom, respectively, and it places more weight on changes around the middle of the income distribution.The following proposition applies when the income distribution F presents a greater level of polarization than the income distribution G,

$$FBG \Longleftrightarrow B_F(\omega_i) \geq B_G(\omega_i) \ \forall \ i = 1, ..., n \ \ and \ \ B_F(\omega_i) > B_G(\omega_i) \ \ for \ some \ i$$

(Proposition 4)

Finally, Foster & Wolfson construct a polarization index consistent with the first and second polarization curves and similar to Gini index. It is defined as twice the area under

the second degree polarization curve: $P = \int_0^1 2B_F(\omega)d\omega$.As mentioned before, this analysis is based on an income distribution which is divided in two group, those with incomes below the median and those with income above the median. For this reason, this index can be defined as a bipolarization index. A greater value could be indicative of greater income spread between these two groups and/or that the group become more sharply defined. The distance between these two groups as proportion of the overall mean is defined as *the relative median deviation*: $T = \left(\mu^U - \mu^L\right)/\mu$. Then, it can be proved that: 1) $T = 2G^B$, in where $G^B$is the between groups Gini index; 2) $G = G^B + G^W$, that is, the Gini index is equal to the sum of the between Gini index $G^B$and the within groups Gini index G^W; and 3) the polarization index is equal to $P = (T - G)\frac{\mu}{m}$, in where μ is the overall mean and m is the median. Based in these three result we can define the polarization index as:

$$P = \left(G^B - G^W\right)\frac{\mu}{m} \tag{4}$$

Equation (4) reflects the fact that an increment in inequality between the two defined groups raises polarization, in other words it increases alienation. However, an increment in inequality in each group decrease polarization, that is, each group is less homogeneous. Equation (4) also tell us that polarization increases depending on the source of inequality and thus, polarization and inequality could or could not go in the same direction. For example, a rise in the spread of the income distribution as a result of a regressive transfer tends to enhance both polarization and inequality. On the other hand, an increment in bipolarization as result of a progressive transfer leads to a growth in polarization but not in inequality.

The polarization measure presented above is focus on the idea of only two income groups. In order to relax this assumption and based on the concepts of alienation and identification, Esteban and Ray (1994) developed a polarization index in which the number of income group are determined by the analyst or by using common rules. Formally,

$$P(F) = \iint T\left(I(y,F), r\left(\delta(y_i, y_j)\right)dF(x)dF(y)\right) \tag{5}$$

where T is the "effective antagonism" between individual y and individual x (under F) which is compouned by the identification function I that measures the degree of association of an individual with a group in terms of income; and the alienation function, which measures the distance (usually the euclidean metric) between the identified income groups. The main drawback of this index is that it assumes that individuals have been "regrouped" in each of the relevant groups. Thus, now the problem is how to set the optimal "partition" for a given number n of groups. Esteban, *et al.* (1999) introduce some refinements to the previous polarization index in order to find out the optimal way to construct the optimal boundaries that define the n groups. Relying on the assumption that the income distribution can be represented by a density function f in a bounded interval, the function f could has an "n-spike" representation denoted by ρ. The "n-spike" representation differs from the actual representation of f, in an error term $\varepsilon(f, \rho)$ which can be called the "grouping error". This error term need to be introduced in order to correct the previous polarization measure. Moreover, the error term $\varepsilon(f, \rho)$ can be defined as $G(f) - G(p^*)$ which is the difference between the gini index using the actual density function and the one that arise from optimally separating the population in definied n number of groups. Thus, this polarization measure is obtained by minimizing the within-group dispersion using a iterative procedure. The new polarization measure is:

$$P(f, \alpha, \beta) = ER(\alpha, \rho) - \beta\varepsilon(f, \rho) \tag{6}$$

where ρ is the "n-spike" representation of the density function f, α is a parameter related to the importance of the identification factor and is defined by the user, and finally β is the weight placed on the grouping error term and it is also a user defined parameter. As a result of the application of this method with $n = 3$, we can define the lower, middle and upper class because we can calculate the values of income that define each category. After that, we characterize the middle class and estimate a multinomial ordered logit to find out the main features of the middle class.

Duclos *et al.* (2004) extend the prior analysis by letting the number of groups be

determined endogenously. The identification process is based on the estimation of a non-parametric Kernel density for the income variable (y_i). The density for a given income range can be viewed as the proportion of population in this range. The degree of identification arise when this proportion or density is powered by the parameter α (with $\alpha \epsilon [0,1]$), which is an ethical parameter that express the level of feeling of identification within a population group given by a level of income. In other words, for each density point "window of identification" is defined. Individuals beloning to a particual window are weighted by their distance with respect to each density point. In this context, the alienation factor is a measure of the income distance between each group previously determinated. Then, the polarization index for the distribution F can be defined as,

$$P_\alpha (F) = \int_y f(y)^\alpha a(y) \, dF(y) \tag{7}$$

where y represent the income variable and F its distribution funtion. The identification effect, which is sensitive to the parameter α,is denoted as $f(y)^\alpha$and finally, $a(y)$ denotes the alienation effect. One drawback of this index is that is subject to the choice of the parameter α, which as we mentioned above is related to the identification process. A higher value of α emphasizes the role of identification in the construction of this polarization indicator. In contrast, when α is zero, there is no weight placed on the identification effect and therefore, the polarization index equals the alienation effect (the Gini index). In order to circumvent such disadvantage, we estimate Duclos *et al.* polarization index for a set of values of α. In addition, $f(y)^\alpha$ is estimated using a Kernel procedure. We use a Gaussian Kernel function and the "optimal" bandwidth is derived by minimizing the mean square error (see Duclos *et al.* for more details).

Finally, the polarization index can be descomposed as it follows,

$$P_\alpha (f) = \bar{a} \; \bar{i}_\alpha [1 + \rho] \tag{8}$$

where $\bar{a}$ is the average alienation effect, $\bar{i}_\alpha$ is the average identification effect and ρ is the

normalized covariance between $\bar{i}_\alpha$ and a. This equation provide us interesting information since we can observe the contribution of each component to polarization.

3 Relative Distribution Approach

Although this approach is different to those previously described, it can be viewed as a complement of them. Based on the "relative distribution" method, this tool is helpful to find changes in patterns across the entire income distribution for a given period and it is also capable of distinguishing between changes in the location and the shape of the income distribution. The theoretical framework is introduced by Handcock and Morris (1998,1999) and assumes that we have two different populations,the "reference" population and the "comparison" population. The initial step is to define a relative rank. First, we introduce some notation: let Y_t and Y_{t+1}be the income variable with cumulative distribution functions F_t and F_{t+1}respectively. Then, a relative rank R between 0 and 1 is defined as $R = F_t\left(y_{t+1}\right)$. This relative rank is considered as a random variable and it quantifies the accumulated mass of population in t according to the income variable in $t+1$. For one realization of R we have, $r = F_t(y_{t+1,r})$ with $0 \leq r \leq 1$ and the associated quantile function $F_t^{-1}(r) = y_{t+1,r}$. Then, the relative distribution function is defined as $G(r) = F_{t+1}(F_t^{-1}(r))$ with $0 \leq r \leq 1$ and the relative density function of interest is defined as,

$$g(r) = \frac{f_{t+1}(F_t^{-1}(r))}{f_t(F_t^{-1}(r))} \quad with\ 0 \leq r \leq 1 \tag{9}$$

where f represent the density function in $t+1$ and t, respectively; $g(r)$ is the relative density function evaluated at the income level of the reference group t at the quantile r.This function is defined as the ratio of the density of the reference group to the density of the comparison group evaluated in the income level of the reference group at quantile r. It has the properties of a density function (for example, it integrates to 1). When the relative density function shows values near to one, it means that the two density function have a similar density at the quantile r of the reference group and thus, R has a uniform distribution

in the interval $[0, 1]$. A relative density greater than one means that the comparison density has more density than the reference density evaluated at the quantile r of the reference group. Finally, a relative density function less than one indicates the opposite.

The density functions are estimated using a non-parametric Kernel method. Once we obtain the estimated relative density functions for different realizations of R, we fit a local polynimial for each estimated point in order to have an accurate description of the relative density. One of the major advantage of this method is the possibility to descompose the relative distribution into location effect, usually associated with changes in the mean of the income distribution, and shape effect, which could be linked with several factors like social policies or polarization for instance. Formally,

$$g(r) = \underbrace{\frac{f_{t+1}(F_t^{-1}(r))}{f_t(F_t^{-1}(r))}}_{Overall\ effect} = \underbrace{\frac{f_{t,L}(y_{t+1,r})}{f_t(y_{t+1,r})}}_{Location\ effect} \times \underbrace{\frac{f_{t+1}(y_{t+1,r})}{f_{t,L}(y_{t+1,r})}}_{Shape\ effect} \quad with\ 0 \leq r \leq 1 \tag{10}$$

where $f_{t+1,L}(y_{t+1,r}) = f_{t+1}(y_{t+1,r} + \rho)$ is a density function adjusted by an additive shift $\rho = median(Y_{t+1}) - median(Y_t)$. An increasing location effect means that the comparison income distribution is greater than the reference income distribution and vice versa. The second term which is the shape effect function is useful to identify movements in the entire distribution function. For instance, as a consequence of the redistributive policies launched in 2005 we could expect a reduction in the upper tail in 2010, which could lead to an increment in the middle class, observing a shape effect function with some sort of U form. We could expect the opposite (an inverse U shape) if we compare the 1994 income distribution with the 2004 income distribution.

This approach also include a "median relative polarization index" that is based on changes in the shape of the income distribution to account for polarization. This index measures the average of the absolute value from the median of the shape effect function normalized to vary between -1 and 1. Negative values indicates that income polarization decreases, while positive values indicates the opposite. When the index takes the value of zero it means that there is no changes in polarization patterns. The index is formally defined for the reference population (period $t + 1$) and the comparison population (period t) as follows,

$$MRP \;\; index = 4 \int_0^1 \left| r - \frac{1}{2} \right| \underbrace{\frac{f_{t+1}(y_{t+1,r})}{f_{t,L}(y_{t+1,r})}}_{g_s(y_{t+1,r})} dr - 1 \tag{11}$$

where $g_s(y_{t+1,r})$ is the shape effect function. The index can be estimated using non-parametric techniques. Finally, the MRP index can be descomposed into a lower and upper relative polarization index, which are also normalized to vary between -1 and 1. These two new indexes can shed light on income bipolarization and therefore on declining middle class issues. They are formally defined as,

$$LRP \;\; index = 8 \int_0^{1/2} \left| r - \frac{1}{2} \right| g_s(y_{t+1,r}) dr - 1 \tag{12}$$

$$URP \;\; index = 8 \int_{1/2}^1 \left| r - \frac{1}{2} \right| g_s(y_{t+1,r}) dr - 1 \tag{13}$$

4 Data and Results

We use the annual National Household Survey (ECH) conducted yearly by the National Statistical Office of Uruguay (INE). We employ cross sectional data for 1994, 2004 and 2010 to analyze two different periods, 1994-2004 and 2004-2010. The first period is characterized by increasing inequality and it comprises the 2002 economic downturn[3], while in the second one redistributive policies were introduced and the real GDP growth was 6% the yearly average .The ECH is the main source of socio-economic information about Uruguayan households and their members at the national level. Due to the fact that the 1994 and 2004 surveys only include households in urban areas with more than 5,000 inhabitants, we restrict the analysis to such population.[4] We are interested in the total household income variable of the the survey. This variable includes all the different sources of income (members ´salaries, pensions, benefits from cash transfer programs, etc) and it also considers the imputed rents (for example in the case of home owners, the imputed rent is the hypothetical value the

[3]The real GDP decreased 11% in 2002 and the unemployment reach 17% in this year.
[4]Note that only around the 5% of the Uruguay population is located in rural areas.

members would have to pay for it). It is necessary to point out that the household income reported in the survey is net of social security and income taxes. Specifically, our outcome variable is the per capita household income in 1997 Uruguayan pesos since we adjusted it by the consumer index price with base in 1997.

4.1 Characterizing the Middle Class

In this section, we define and characterize the middle class following Esteban, *et al.* (1999) and then we compare it with the other social classes (lower and upper). In Figure 1, we observe the density of the (log) real household income jointly with the middle class boundaries in 1994, 2004 and 2010. In 1994 and 2010 the definition seems to be quite similar, while in 2004 the middle class interval has a left shift probably explained by the 2002 economic crisis.

Based on these middle class intervals, Table 1 shows summary statistics of the middle classes. First of all, we observe that in Uruguay around 37% of the households belong to the middle class. The low class income is the greatest with 45% approximately and the high class represents the smallest (around 12%). Therefore, Uruguay is basically compounded by low and middle income households. Other interesting feature is that we observe a great income dispersion in the high class, while the low class appear to be more homogeneous. Also, the income share of the middle and high class seems to be similar between 1994 and 2010, despite their size differences. As it is expected, the income share of the low class decreases in 2004, while that of the high class increases.

We present a second group of indicators that are related to education. Overall, we observe that educational attainment increases from the low to the high class. For instance, if we consider the average years of education of adult household members, the high class has the greatest average while the low class has the lowest[5]. The level of the attendance rate is similar across classes for the age cohort [6,12][6]. However, when we take into account higher cohorts the attendance rate decreases, mainly in the low class case. In addition, the low class show a high level of education gap in children between 7 and 15 years old in comparison with

[5]The same conclusion arises when we consider the average years of education of the head of household.
[6]This is not surpring since primary school attendance is almost universal.

the middle and high class. Both of them (middle and upper) have a similar education gap.

Regarding living conditions, around the 70% of the middle class household are homeownership. Nevertheless, it is interesting to point out that this proportion decline in recent years and around 64% are homeownership in 2010. This fact also applies for the other social classes. In addition, there is a considerably difference in terms of overcrowded households between the lower and the middle and the upper class. Sanitation is another variable that rises as we move to a higher income classes. We construct an asset index as a weighted average of a series of indicator variables for the availability of the following assets at home: refrigerator, dishwasher, laundry machine, regular TV, internet connection, computer, car and household help. The weights are the relative distance between 1 and the proportion of households having this item and therefore the index places more weight on items possesed only by few households. The index varies between 0 and 1. The asset index shows a difference between the low and middle of around 0.10 points and this gap remains constant for the three years. The asset gap between the middle and high class is wider (approximately 0.14). We construct another wealth index with the same variables but considering a normal standarized transformation of them. In this case, we observe higher gaps and this index varies on a higher set of values than before.

In what concerns to population composition, the low class is compounded by younger people in relation with the other classes. The middle and upper have more adults with more than 60 years old.

The labor status indicators show that the unemployment rate is the highest for the lower income class. The majority of the middle class workers are wage earners. In second place we have self-employed and entrepreneur is third. This pattern is quite similar in the other class categories. The major difference is that the high income class has a greater proportion of workers in the entrepreneur category. We use the definition of informal workers adopted by the International Labour Organization in the 15^{th} International Conference of Labor Statisticians (1993), which consider informal workers as those who work in the housekeeping sector, unpaid household members, private wage earners working in firms with less than five employees and self-empolyed workers (excluding administrative, professionals

and technicians). Using this definition, the highest proportion of informal workers is in the low income class. The proportion of informal workers in the middle class in 1994 is just over 0.17 and it decreases in 2004 and in 2010. Finally, the middle and high class show a similar share of inactive people.

Table 2 presents multinomial logit estimates for the three years. As dependent variable we use the category variable which takes the value of 1 if the household belongs to the low income class, 2 if it belongs to the middle and 3 if belongs to the high income class. We consider the middle class as the base category and we report the marginal effects. It is interesting to point out that the signs of the coefficients do not change when we consider differents years and that almost all the coefficient are statistically different from zero at the 1% level. For instance, the probability of being a low class household (with respect of being a middle class household) decrease whether the household is in the capital city (Montevideo). The opposite happend if we analyze the probability of being a high income household. This fact could be associated with different living cost between the capital and the rest of the country. As mentioned earlier, households with young children have higher probabilities of being low income class than middle class. The same fact holds for the household size variable. A more educated head of household rises the probabilities of being high income class and decline the probability of being low income class (with respect to the middle). In what concerns to labor market variables, unemployed or informal head of household increase the probabilities of being low class income, while decrease the probability of being high. In addition, whether the head of household is an enterpreneur grows the probability of being high. The housing variables have the expected signs.

Because in this case the dependent variable seems to have a natural order, an ordered logit model appears as the most appropriate. However, if this assumption does not hold we will have a bias estimator. Otherwise, the ordered logit model produces more efficient estimates than the multinomial logit. However, the results of both models are quite similar and then we do not report the ordered logit estimation.[7]

[7]The results are available from the authors upon request.

4.2 Evolution of the Middle Class and Polarization

In this section, we apply the methodology related to the evolution of the middle class and the polarization measures. Table 3 presents summary statistics that helps us to describe the income distribution for the different years. As we can see, the mean and the median of the income distribution fell between 1994 and 2004 and both of them increased in 2010. The mean is greater than the median indicating that the income distribution is left skewed. With respect to income concentration, the first quantile has approximately 5% of the total income, while the fifth quantile represent the 50%, approximately. Interestingly, during the first period the proportion of the first quantile declines whereas that of the fifth rises. In the second period we observed the opposite pattern. This also can be viewed in the income share measures. The bottom five percentile has an income share of just under 1% and decrease in the first period and after that it increases. The top five percentile has an income share of 20% in 1994, which rise one percent point and then declines to just over 20%. The next group of indicators measure the population share given a specific income range. For instance, we observe that there is a 10% of households with income less than 40% of the median in 1994, and so on. Considering low and high income values as percentage of the median, we observe that the population share growth in the first period and in the subsequent period it drops. However, if we consider income intervals near or around the median this trend reverses. This fact give us the preception of a deterioration in the middle class during the period 1994-2004, which then increase in the next period.

Using the M curve, this perception is confirmed. The middle class decreased around 3% throughout the period 1994-2004 (a movement away from the middle to both upwards and downwards), and then rise two percent points in the following period. When analyzing different population ranges around the middle, we also observe that a greater income spread is required to capture those ranges in 2004, reflecting a greater income spread in the income distribution in this latter year. For example, given a population rage between 20% and 80%, we require an income spread of 141% of the median income in 2004. This percentage is reduced 8% in 2010.

All these observed features are illustrated in Figure 2. In the top panels we plot the M - curve, which is aimed to measure the concentration of mass around the median of the income distribution. We observe that the M curve of the income distribution of 1994 is above the M curve of the income distribution of 2004 (and they do not cross each other), and thus Proposition (1) holds: "the income distribution function in 1994 has an unambiguously larger middle class than the income distribution function in 2004". In other words, the 1994 income distribution has more mass around the median than the 2004 income distribution. Moreover, the first and second degree polarization curves (middle and lower panels) lead to the same conclusions than before. From the observation of those latter curves, we find out that polarization in the income distribution in 2004 is higher than polarization in the income distribution in 1994, revealing that the latter has a greater income spread. Since a greater income spread implies less proportion of population around the middle, Proposition (3) means that the1994 income distribution has a greater middle class than the 2004 income distribution and therefore, the former dominates the latter. Additionaly, the second degree polarization curve in 1994 is below the second degree polarization curve in 2004, which implies that the income distribution in 2004 has a greater spread, as well as, a greater bipolarity than the income distribution in 1994. The second period, 2004-2010, shows the opposite picture. The middle class increases while polarization tends to decline.

Table 4 shows inequality and polarization indices.The inequality indicators show a sharp increase between 1994 and 2004. For instance, the Gini index rises from 0.409 to 0.439. The Generalized entropy index, the Atkinson index and the Coefficient of variation index increase 0.054, 0.021 and 0.143 points, respectively. As mentioned above, this period is characterized by a tendency toward increasing inequality which is enhaced by the economic downturn initiated in the late nineties. This period of growing inequality is also accompanied by a relevant rising in income polarization. Duclos, et. al. index grows around 0.015 for differents level of identification represented by the parameter α. That is, for different values of α the change in the Duclos *et al.* index between 1994 and 2004 is statistically different from zero at the 1% level. A greater value of α means that more emphasis is placed on the identification process. In order to analyze the contribution of each of the sources of polarization, the index

can be descomposed into three (multiplicative) components: identification, alienation (which is equal to the gini index) and correlation (between the latter measures). It is interesting to point out that while the alienation and correlation components evolve positively, the identification component declines. This results holds for different values of the α parameter. In other words, polarization basically increases because the gap between the identified group rises. For the second period, 2004-2010, the first main result is a decline in inequality. With the exception of the coefficient of variation index, the reduction is statistically different from zero. The second interesting result is that, as we have already noticed, is that polarization falls. If we focus on the Duclos, et al. (2004) index the magnitude of the reduction decreases with the value of the α parameter. This can be explained by the fact that we weight the most the identification effect which in this case goes in the opposite direction. Despite polarization decline slightly, the identification component rises but not enough to outset the reduction of the alienation effect.

The Foster and Wolfson polarization measures deserve a quite similar lecture. In the first period, we observe an increase in the bipolarization index which is statistically significant. In this case, we observe a increase in inequality within and between the two groups. [8] Therefore, both groups spread out and the distance between them increases ("increased spread" and "increased bipolarity"). In the second period, the reduction in the within and the between Gini indices indicates a decreases in polarization.

We apply the relative distribution approach in order to find changes in the whole income distribution. Figure 3 shows the actual income distribution in 1994 and 2004 in the left plot and the relative distribution in the right plot in the top panel. At first glance, we observe a shift from the right to the left which implies a reduction of the mean income in this period. On the contrary, we observe a shift from the left to the right in the income distribution during the period 2004-2010 (see lower panel of Figure 3).

In Figure 4, we observe the location and the shape effect. The left plots confirm our prior observation since we find a decreasing and increasing location effect for the first and second period, respectively. The right (top) plot shows how the lower and upper tail of the

[8] As previously mentioned Foster and Wolfson identify only two groups, those above and those below the median of the income distribution.

income distribution increase during the 1994-2004 period. This fact supports prior findings cocerning a decline arround the middle of the income distribution. In the other period, the shape effect shows that the lower and upper tail decline and the middle increase slightly. To formalize this result, and based on the relative density, we calculate relative polarization measures where positive values means that polarization increase. In fact, we observe positive values and statistically different fro zero for the three measures in the first period. In the second period, the three indices are negative. This means that polarization decreases which is in line with our previous findings. However, the change is smaller than in the first period.

To summarize, throughout the nineties and until 2004 the income distribution become more unequal distributed and more polarized and then middle class decrease considerably, while during the period 2004-2010, we observe some improvements.

4.3 Robustness Analysis

In order to analyze the robustness of are our results, we do not impute as household income the health services derived from the new health system (NHS) implemented in 2008.[9] In the new scheme, children under 18 years old of formal employees automatically acquired the right of medical services and therefore, they do not have to pay the monthly payment.[10] The reform implies an important increase in the number of affiliations in the private hospitals.[11]

The National Statistical Office of Uruguay (INE) decided to account for this change imputing a monthly payment in the household income for health services[12]. From a theoretical point of view it is not clear if we have to include this as income. If we do not impute this income the results could change because the income distribution is sensitive to this imputation (mainly for low income households). As we can see in Table 3 (fourth

[9] For a complete discussion of the 2008 health reform see Bérgolo and Cruces (2010).

[10] This change was financed with an increase in worker's contribution.

[11] The Ministry of Public Health states that the number of customers of a Collective Health Care Institution, which is the main private health supplier, increased in 314,976 between December of 2007 and December of 2008.

[12] In 2004, INE also includes in the household income the amount which account for the health service of each member which was a wage earner.

and fifth column) the proportion of income in the first and in the second quantiles decreases. What is more, the percentage of households around the median drops while the proportion in the extreme's tend to increases. This fact is confirmed in the summary statistics related to the M curve. We concluded that the middle class increases in the previous section. However, if we do not included as household income the imputation for the health reform (as well as the imputed income for health service to wage earners in 2004), the change in the middle is ambiguous. This fact can be viewed graphically in Figure 5 in where the M curve of the income distribution of 2004 is still below the M curve of the income distribution of 2010, but around the middle both curves are quite similar. This result implies that the middle class increases. Nevertheless, around the middle its increment is not so pronounced as we observed in the previous section. The same is also observed when we look to the shape effect panel, in where the extreme'spoles seems to have decline and the middle increase, but in a lower level than the previous section.

With respect to to polarization and inequality measures in Table 4, the different indicators decreases as before, but to a lesser extent. For instance, the Gini index decreases from 0.447 in 2004 to 0.432 in 2010 (it decreases 0.015 points), while if we do not impute income for health services the decline is 0.021. The same pictures holds for the other indices where the changes are statistically different from zero, but with a lower change than in the original case. Furthermore, polarization grows for different values of the α parameter. In this case, the most important component of polarization is alienation since identification remains steady. Therefore, the higher value of α, the lower effect that we are going to find. The cocnlusions are the same with respect to the Foster and Wolfson.

5 Concluding Remarks

In the last years there is a increasing concern about inequality and polarization. The expansion of the middle class is one of the key issues towards lower inequality and lower polarizaton. From an economic and social perspective, the middle class could play an important role in the development of a democratic country since it contributes with a

signficant share of the labor force, and therefore is closely related with the country´s output and usually represents the main source of tax revenue for the country. Furthermore, an increase in the middle class because of the reduction of the lower and upper class could enhance the positive externalities mentioned above, reduce income inequality, and the antagonism between classes which is an important source of social tensions.

We analyze the middle class and polarization in Uruguay in the last two decades. We conclude that the middle class declined and income polarization increased between 1994 and 2004, while the situation is the opposite between 2004 and 2010. However, when we do not include the income imputation because of the health reform implemented in 2008 results tend to be attenuated. In other words, the increases in the middle class between 2004 and 2010 is lower than before and the magnitude of the declines is sensible to the health income imputation. This fact highlights the importance of the analysis of income imputation when using household surveys.

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Table 1. Characteristics of social classes. Summary statistics

	1994			2004			2010		
Variables	Low	Middle	High	Low	Middle	High	Low	Middle	High
% of persons	54.17	32.50	13.33	58.29	30.16	11.56	56.62	31.37	12.01
% of households	44.57	37.26	18.17	46.42	36.95	16.62	45.45	37.15	17.40
Average (per capita) household income	1,977	4,578	11,427	1,346	3,396	9,252	2,103	4,975	12,891
Standard deviation	716.72	1,002	6,134	520	794	5,859	751	1,115	8,782
Household income share	25.68	37.26	37.06	23.14	35.33	41.53	26.01	37.03	36.96
% of labor income	61.67	60.28	60.1	60.06	58.17	57.21	58.88	60.96	59.15
% of hhs below the poverty line	29.69	0.00	0.00	57.33	0.00	0.00	27.72	0.00	0.00
% of hhs below the extreme poverty line	1.56	0.00	0.00	4.66	0.00	0.00	1.11	0.00	0.00
Education									
Average household education	6.47	7.85	10.8	7.56	9.24	12.50	7.59	9.61	12.80
% households in <7	51.98	38.80	16.88	36.36	27.59	11.08	34.73	23.19	9.25
% households in [7,9]	32.85	28.58	18.26	38.02	23.08	10.04	40.36	23.75	9.88
% households in [10,12]	12.02	21.34	28.70	20.36	27.77	24.53	19.97	29.99	25.65
% households in >12	2.97	11.27	36.16	5.25	21.56	54.36	4.94	23.07	55.22
Head of hhld years of education	6.05	7.41	10.74	7.17	8.94	12.60	7.30	9.38	12.80
% head of hhld with completed high school	10.34	20.44	47.47	9.51	28.14	62.9	8.34	28.24	61.23
% head of hhld with a university degree	0.59	2.79	15.59	0.65	5.23	24.19	0.28	3.01	16.04
Attendance rate by age interval:									
[6,12]	98.23	99.78	99.53	98.34	99.23	99.14	98.88	99.12	99.51
[13,17]	68.86	86.56	94.47	82.83	95.84	99.45	80.56	95.09	98.68
[18,23]	20.95	42.46	61.83	33.59	64.99	83.05	28.42	55.85	77.55
% of children in [7,15] with education gap	43.16	25.69	26.48	46.64	27.00	26.68	47.22	29.02	28.69
Living conditions									
House ownership	59.91	73.27	81.05	57.88	71.24	81.17	54.38	63.65	71.65
Person per room	2.07	1.45	1.18	2.00	1.38	1.20	1.87	1.28	1.03
% of overcrowded households	30.60	7.05	1.32	27.02	3.64	0.93	22.66	2.74	0.37
Water supply - general network	97.22	98.44	99.43	98.24	99.22	99.75	98.17	98.95	99.57
Network evacuation	44.62	69.90	91.08	52.91	78.07	92.50	48.74	71.90	87.15
Asset index	0.14	0.22	0.33	0.17	0.29	0.42	0.24	0.33	0.44
Wealth Index	-0.80	0.10	1.22	-1.14	0.33	1.60	-1.04	0.40	1.70
Household size	3.92	2.81	2.34	3.83	2.52	2.15	3.54	2.40	1.95
Population composition									
Children aged 0-5	11.38	5.53	3.65	10.91	4.49	3.46	10.43	4.75	3.40
Children age 12-17	16.37	8.47	6.37	16.64	7.15	5.49	17.09	7.25	4.91
Adults >60	14.63	26.62	29.22	13.16	29.36	33.73	12.83	26.19	31.77
Labor status									
Employment rate	86.27	94.37	96.63	81.73	91.69	95.53	89.50	95.85	97.67
Wage earner	63.56	69.19	63.16	54.89	68.64	65.70	63.68	73.27	68.69
Self-employed	19.65	18.51	18.77	24.06	17.78	18.17	22.77	16.72	16.77
Entrepreneur	1.37	4.77	12.86	1.08	4.16	10.70	1.73	5.07	11.61
Zero income	1.67	1.89	1.79	1.69	1.10	0.96	1.27	0.78	0.58
Informal workers	27.64	17.33	10.65	25.47	14.33	6.91	25.24	13.05	5.22
Unemployment rate	13.72	5.62	3.37	18.26	8.30	4.46	10.49	4.14	2.32
% of inactive	30.48	36.01	35.21	29.05	37.64	38.18	27.16	31.30	32.33
% of retired	8.00	13.56	11.63	6.82	19.19	20.90	5.98	15.60	18.30

Source: Own calculation based on the Uruguayan National Household Survey (ECH).

Note: Calculation based on the real per capita household income in 1997 Uruguayan pesos, net of social security and income tax. Data weighted using sample weights.

Table 2a. Multinomial logit estimation

	1994		2004		2010	
Variables	Low	High	Low	High	Low	High
Capital	-0.132***	0.074***	-0.044***	0.055***	-0.028***	0.037***
	(0.007)	(0.006)	(0.007)	(0.006)	(0.005)	(0.004)
Household with children aged 0-5	0.080***	-0.048***	0.051***	-0.031***	0.075***	-0.032***
	(0.009)	(0.008)	(0.008)	(0.009)	(0.006)	(0.006)
Household with children age 12-17	0.094***	-0.042***	0.078***	-0.027***	0.099***	-0.034***
	(0.008)	(0.007)	(0.008)	(0.008)	(0.005)	(0.005)
Household with adults >60	-0.047***	0.019***	-0.055***	0.038***	-0.041***	0.015***
	(0.008)	(0.006)	(0.008)	(0.006)	(0.006)	(0.004)
Household size	0.083***	-0.075***	0.098***	-0.073***	0.111***	-0.088***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Head of hhld average education	-0.017***	0.015***	-0.018***	0.016***	-0.022***	0.016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Head of hhld unemployed	0.190***	-0.069***	0.153***	-0.118***	0.134***	-0.081***
	(0.022)	(0.020)	(0.015)	(0.020)	(0.013)	(0.014)
Head of hhld occupation: entrepreneur	-0.111***	0.072***	-0.099***	0.079***	-0.083***	0.072***
	(0.016)	(0.008)	(0.018)	(0.009)	(0.011)	(0.006)
Households with informal workers	0.032***	-0.040***	0.025***	-0.030***	0.052***	-0.052***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.005)	(0.005)
House ownership	-0.094***	0.059***	-0.043***	0.046***	-0.048***	0.046***
	(0.007)	(0.006)	(0.007)	(0.006)	(0.004)	(0.004)
Overcrowded households	0.060***	-0.042***	0.047***	-0.032*	0.031***	-0.050***
	(0.010)	(0.016)	(0.012)	(0.019)	(0.009)	(0.019)
Network evacuation	-0.060***	0.051***	-0.032***	0.005	-0.044***	0.017***
	(0.007)	(0.007)	(0.008)	(0.009)	(0.005)	(0.005)
Wealth index	-0.080***	0.050***	-0.078***	0.049***	-0.071***	0.046***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Pseudo R^2	0.374	0.374	0.414	0.414	0.395	0.395
Log Likelihood	-7,678.08	-7,678.08	-7,064.40	-7,064.40	-17,023.34	-17,023.34
Observations	11.906	11.906	11.748	11.748	27.914	27.914

Marginal effects and roubst standard errors reported.

Base category = middle class

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2b. Ordered logit estimation

	1994	2004	2010
Variables	Middle	Middle	Middle
Capital	0.042***	0.015***	0.012***
	(0.002)	(0.002)	(0.001)
Household with children aged 0-5	-0.026***	-0.013***	-0.021***
	(0.003)	(0.002)	(0.002)
Household with children age 12-17	-0.028***	-0.018***	-0.026***
	(0.002)	(0.002)	(0.001)
Household with adults >60	0.013***	0.015***	0.010***
	(0.002)	(0.002)	(0.001)
Household size	-0.030***	-0.027***	-0.035***
	(0.001)	(0.001)	(0.001)
Head of hhld average education	0.007***	0.006***	0.007***
	(0.000)	(0.000)	(0.000)
Head of hhld unemployed	-0.056***	-0.043***	-0.040***
	(0.007)	(0.004)	(0.004)
Head of hhld occupation: entrepreneur	0.035***	0.028***	0.029***
	(0.004)	(0.003)	(0.002)
Households with informal workers	-0.013***	-0.008***	-0.017***
	(0.002)	(0.002)	(0.001)
House ownership	0.031***	0.014***	0.017***
	(0.002)	(0.002)	(0.001)
Overcrowded households	-0.015***	-0.012***	-0.007***
	(0.003)	(0.003)	(0.003)
Network evacuation	0.021***	0.007***	0.012***
	(0.002)	(0.002)	(0.001)
Wealth index	0.025***	0.021***	0.021***
	(0.001)	(0.001)	(0.000)
Pseudo R^2	0.368	0.413	0.393
Log Likelihood	-7,756.56	-7,077.75	-17,140.93
Observations	11.906	11.748	27.914

Marginal effects and roubst standard errors reported.

Base category = middle class

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3. Description of the income distribution and middle class measures

	1994	2004	2010	2004[a]	2010[b]	Diff 2004-1994	Diff 2010-2004	Diff 2010[b]-2004[a]
Centrality measures								
Mean	4,664	3,374	5,003	3,262	4,791	-1,290.47	1,628.91	1,529.40
Median	3,476	2,410	3,669	3,286	3,444	-1,066.44	1,259.58	1157,.61
Median/mean	74.53	71.43	73.35	70.09	71.88	-3.10	1.92	1.79
Quantiles (%)								
1st Quantile	5.61	4.22	5.17	4.14	4.88 6	-0.66	0.95	0.74
2sd Quantile	10.32	8.27	9.63	8.04	9.18	-0.85	1.36	1.14
3rd Quantile	14.99	13.03	14.34	12.86	14.04	-0.61	1.31	1.18
4th Quantile	21.96	20.69	21.50	20.43	21.40	-0.22	0.81	0.95
5th Quantile	47.12	53.80	49.37	54.54	50.49	2.34	-4.43	-4.05
Income share (%)								
Bottom 5%	0.78	0.71	0.81	0.71	0.77	-0.07	0.10	0.06
Bottom 10%	2.07	1.83	2.07	1.82	1.94	-0.24	0.24	0.12
Bottom 20%	5.60	4.94	5.50	4.85	5.16	-0.66	0.56	0.31
Top 20%	47.13	49.47	47.83	50.19	48.95	2.34	-1.64	-1.24
Top 10%	30.84	33.15	31.61	33.79	32.52	2.31	-1.54	-1.27
Top 5%	19.69	21.65	20.46	22.14	22.13	1.96	-1.19	-0.01
% of Population with incomes:								
< 40% of median	10.38	12.68	10.71	12.81	11.9	2.30	-1.97	-0.91
< 50% of median	16.61	19.39	17.10	19.56	18.22	2.78	-2.29	-1.34
< 60% of median	23.41	26.20	24.14	26.38	25.35	2.79	-2.06	-1.03
60% to 75%	10.76	9.26	10.58	9.27	10.28 8.92	-1.50	1.32	1.01
75% to 100%	15.82	14.54	15.28	14.34	14.38	-1.28	0.74	0.04
100% to 125%	12.71	11.24	11.93	10.88	11.38	-1.47	0.69	0.50
125% to 150%	8.80	8.79	8.99	8.51	8.83	-0.01	0.20	0.32
> 200%	17.57	18.60	17.78	19.28	18.75	1.03	-0.82	-0.53
% in M curve given income range								
75% to 150% of median	37.33	34.57	36.19	33.73	34.59	-2.76	1.62	0.86
75% to 125%	28.53	25.78	27.20	25.22	25.76	-2.75	1.42	0.54
50% to 150%	54.90	50.64	53.82	49.82	51.99	-4.26	3.18	2.17
S given pop range:								
40% to 60%	35.58	39.92	37.23	40.87	39.26	4.34	-2.69	-1.61
35% to 65%	54.34	60.38	57.22	62.24	60.20	6.04	-3.16	-2.04
30% to 70%	75.30	83.80	79.08	86.08	82.57	8.50	-4.72	-3.51
25% to 75%	100.47	109.91	103.67	113.47	109.12	9.44	-6.24	-4.35
20% to 80%	131.25	141.30	133.23	144.78	140.3	10.05	-8.07	-4.48
Avg distance given pop range:								
40% to 60%	1,006	1,009	1,007	1,009	1.005	0.003	-0.002	-0.004
35% to 65%	1,011	1,019	1,014	1,020	1.013	0.008	-0.005	-0.007
30% to 70%	1,021	1,033	1,025	1.036	1,025	0.012	-0.008	-0.011
25% to 75%	1,036	1,051	1,042	1,055	1.044	0.015	-0.009	-0.011
20% to 80%	1,057	1,078	1,064	1,083	1.069	0.021	-0.014	-0.015
Observations	18,386	18,392	40,539	18,392	40,539			

Source: Own calculation based on the Uruguayan National Household Survey (ECH).

Note: Calculation based on the real per capita household income in 1997 Uruguayan pesos, net of social security and income tax.

Income data weighted using sample weights.

a household income without considering the old health system (OHS) income

b household income without considering the new health system (NMS) income

Table 4. Polarization and inequality measures

	1994	2004	2010	2004[a]	2010[b]	Diff 2004-1994	Diff 2010-2004	Diff 2010[b]-2004[a]
Inequality								
Gini index	0.409 (0.003)	0.439 (0.003)	0.418 (0.002)	0.447 (0.003)	0.432 (0.002)	0.030***	-0.021***	-0.015***
Generalized entropy index	0.298 (0.005)	0.353 (0.008)	0.321 (0.011)	0.366 (0.008)	0.343 (0.007)	0.054***	-0.032***	0.023**
Atkinson index	0.136 (0.002)	0.158 (0.002)	0.143 (0.002)	0.163 (0.003)	0.152 (0.002)	0.021***	-0.015***	-0.011***
Coefficient of variation index	0.934 (0.016)	1.077 (0.038)	1.049 (0.039)	1.106 (0.040)	1.092 (0.040)	0.143***	-0.028	-0.013
Polarization								
			Duclos, Esteban and Ray (polarization) Index					
α=0.25	0.299 (0.001)	0.317 (0.002)	0.305 (0.001)	0.322 (0.002)	0.314 (0.001)	0.018***	-0.013***	0.008***
Identification	0.834	0.817	0.831	0.818	0.829			
Correlation	0.877	0.884	0.878	0.881	0.877			
α = 0.50	0.243 (0.001)	0.258 (0.001)	0.249 (0.001)	0.262 (0.001)	0.256 (0.001)	0.015***	-0.009***	-0.006***
Identification	0.725	0.702	0.723	0.704	0.720			
Correlation	0.819	0.837	0.824	0.833	0.823			
α = 0.75	0.209 (0.001)	0.222 (0.001)	0.215 (0.001)	0.226 (0.002)	0.221 (0.001)	0.013***	-0.007***	-0.005**
Identification	0.646	0.621	0.645	0.625	0.642			
Correlation	0.791	0.814	0.797	0.809	0.797			
			Foster and Wolfson					
Relative median deviation	0.545	0.582	0.555	0.591	0.574	0.037***	-0.014***	-0.017***
Bipolarization Index	0.182	0.200	0.188	0.206	0.197	0.018***	-0.012***	-0.009***
Within gini index	0.137	0.148	0.140	0.151	0.145	0.011***	-0.008***	-0.006***
Between gini index	0.272	0.291	0.278	0.296	0.287	0.019***	-0.014***	-0.009***
Observations	18.386	18.392	40.539	18,392	40,539			

Source: Own calculation based on the Uruguayan National Household Survey (ECH).

Note: Calculation based on the real per capita household income in 1997 Uruguayan pesos net of social security and income taxes.

Income data weighted using sample weights.

a household income without considering the old healt system (OHS) income

b household income without considering the new health system (NMS) income

*significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. Relative polarization measures

	1994-2004	2004-2010	2004^{a}-2010^{b}
Median relative polarization index	0.069*** (0.006)	-0.052*** (0.005)	0.035*** (0.005)
Lower relative polarization index	0.076*** (0.010)	-0.058*** (0.009)	-0.041*** (0.009)
Upper relative polarization index	0.062*** (0.010)	-0.045*** (0.009)	-0.029*** (0.009)

Source: Own calculation based on the Uruguayan National Household Survey (ECH).

Note: Calculation based on the real per capita household income in 1997 Uruguayan pesos,

net of social security and income tax.Income data weighted using sample weights.

a household income without considering the old health system (OHS) income

b household income without considering the new health system (NMS) income

* significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1
Middle class definition

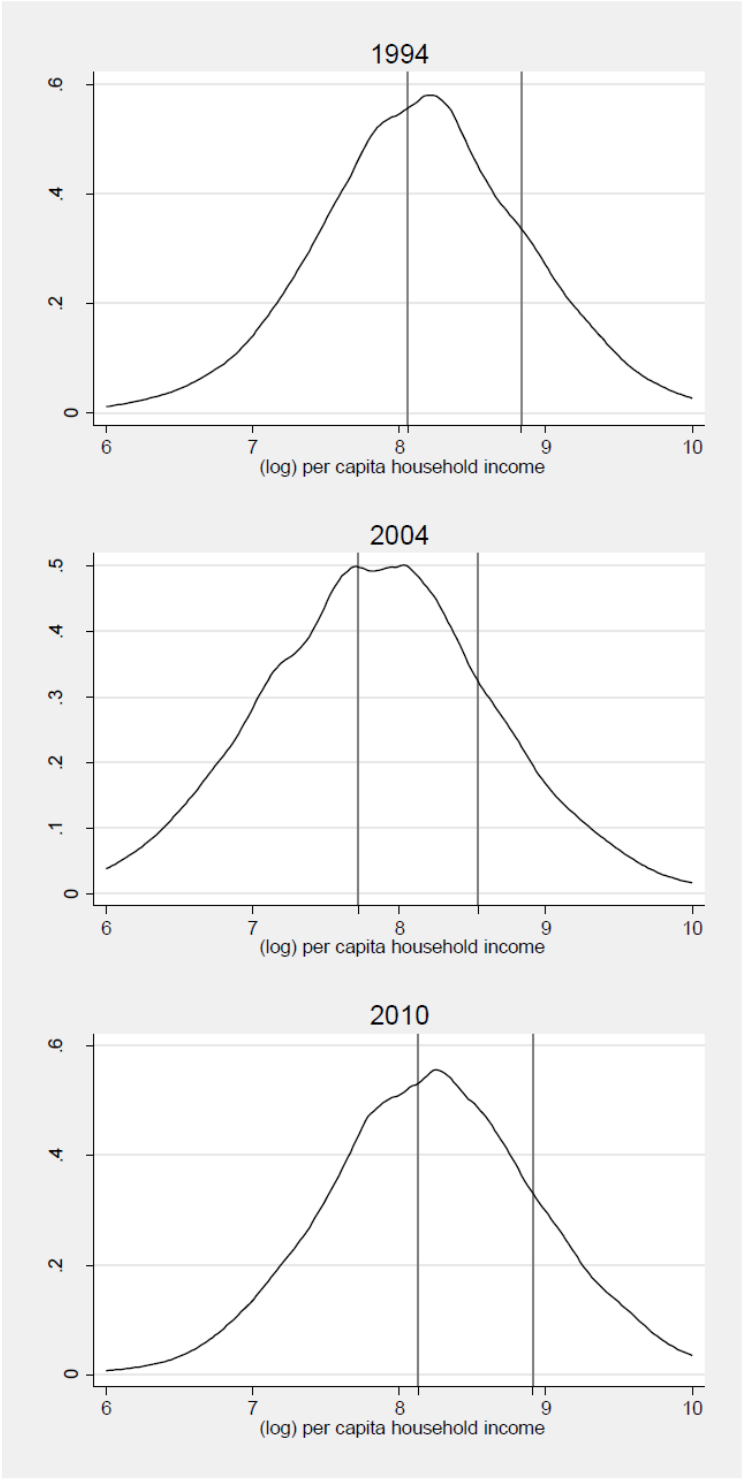

Figure 2
Middle class and polarization curves

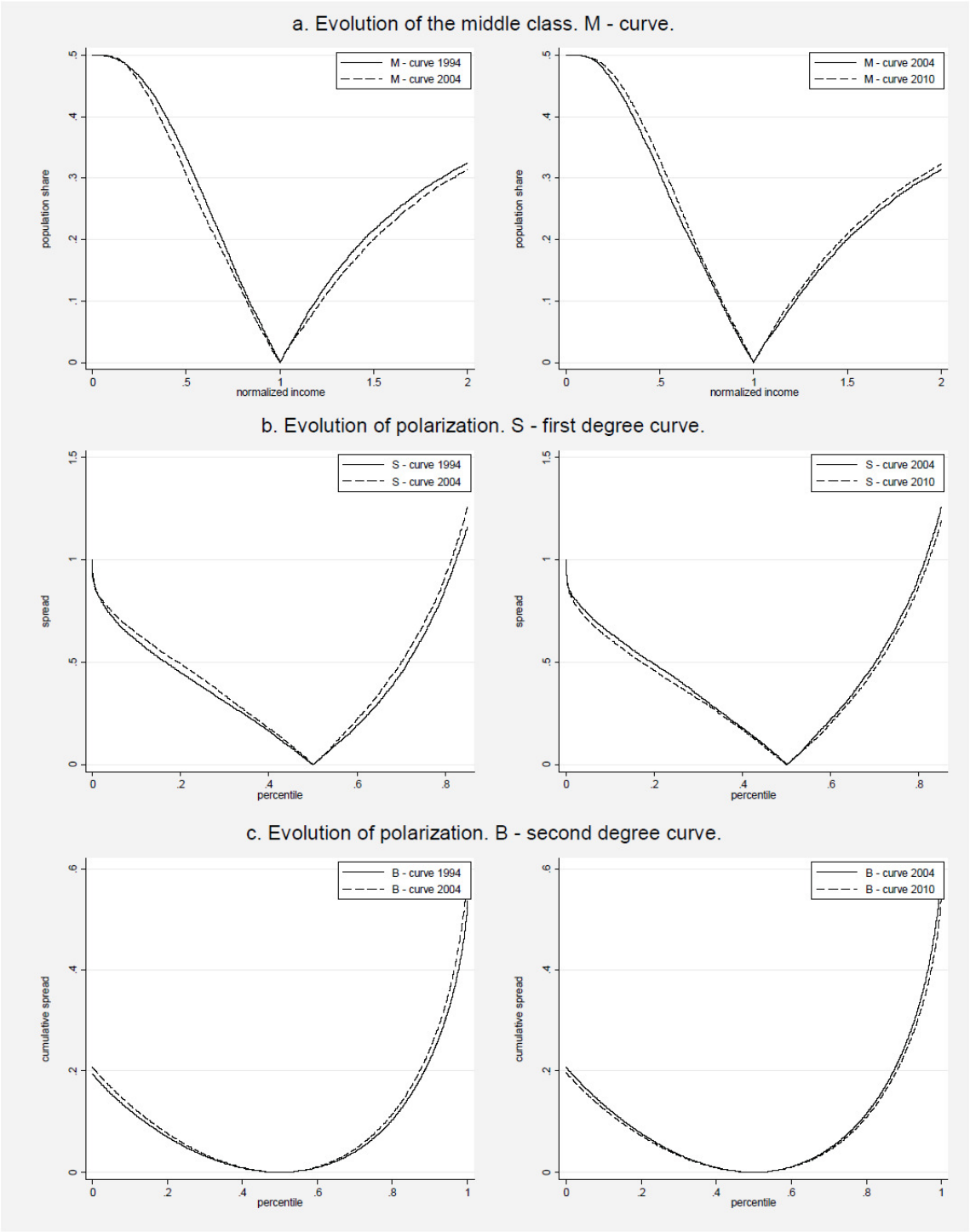

Figure 3
Actual and relative density

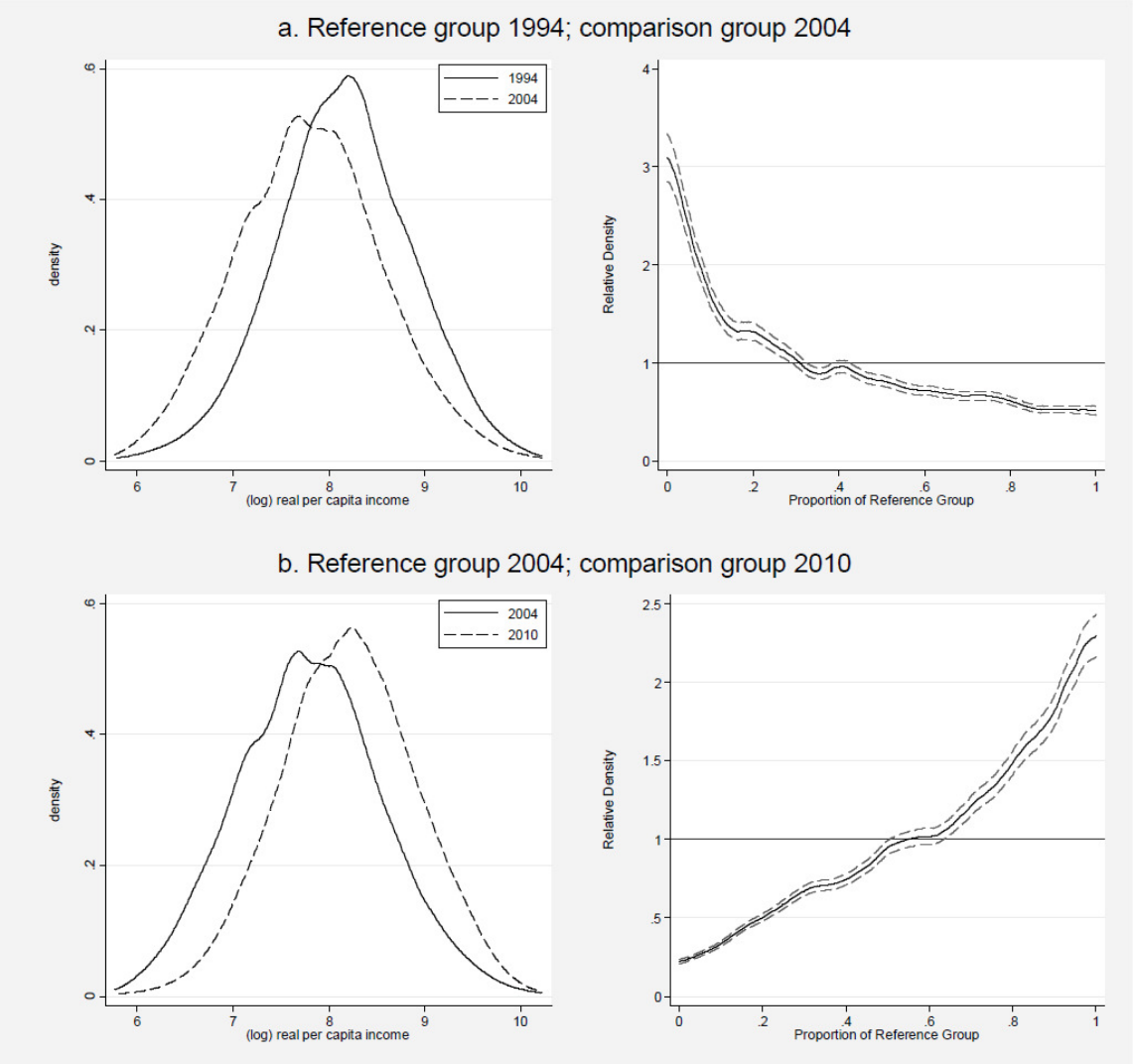

Figure 4
Location and shape effects

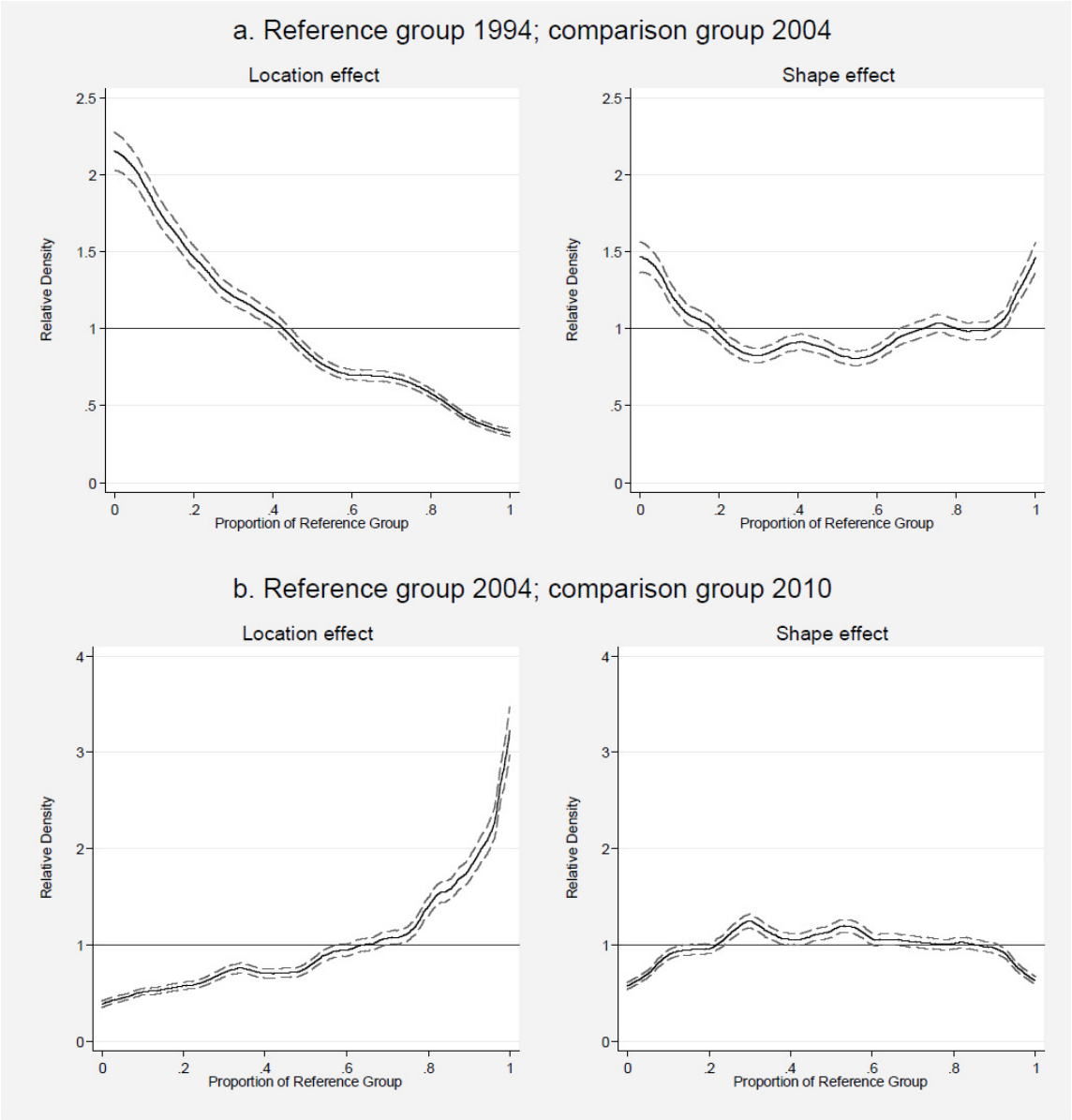

Figure 5
Robustness analysis