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How to measure the middle class: approaches from economics

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Abstract

The middle class has always been considered important especially for democracy and economic growth but the concept of middle class is differently defined and measured by social researchers. Even though the sociological literature analyses the evolution of social classes taking into account multiple dimensions, most economic studies consider classes focusing solely on income stratification and, in general, categorise as the "middle class" the middle-income groups in absolute or relative terms. The consequences of this practice are that it is difficult to identify stable criteria to define and operationalise the theoretical concept of the "middle class", and empirical results depend on the way that group is defined. Other approaches, drawn from the studies of polarization, respond to the need for less arbitrary analysis of the middle class. This paper aims to provide a literature review of the different approaches in economics to explore the dimension and the evolution of the middle class in heterogeneous contexts, examining the rationale for the various definitions and illustrating their implications in the empirical analysis and the public debate.

Key-words

Middle class; income stratification.

Biography of the author

Chiara Assunta Ricci ha conseguito il dottorato di ricerca in Economia Politica alla Sapienza, Università di Roma ed è Economic Officer presso Ministero dell'Economia e delle Finanze (MEF).

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1. Introduction

The presence of a large middle class is considered by several authors as an important determinant of democracy, social stability and economic growth both in the United States and in Europe, but also in many developing regions. The idea that the middle class is a stabilising force can be traced back at least to Aristotle. In "Politics", Aristotle discusses the virtues of the middle class and how it can balance the vices of the two extreme classes (i.e. the rich and the poor). More recently, Adelman and Morris (1967), Landes (1998), Pressman (2007), Estache and Leipziger (2009), Littrell et al. (2010) and many other researchers emphasise the role of the middle class for the development of democracy, social cohesion, economic prosperity and political stability. These studies consider the middle class as a driving force to facilitate growth by promoting stability, human capital accumulation, and better infrastructure. Furthermore, international organizations such as the OECD (2019) recognized the importance of the middle class to sustain consumption, drive the large part of investments in education, health and housing and play a key role in supporting social protection systems through its tax contributions.

For many years, distributional studies have focused mainly on the poor and/or on the rich, without taking into account those who fall between the two ends of the income distribution. Nevertheless, starting from the 1980s and especially since the 2000s there has been an increasing perception that the middle class in Europe and the United States has been shrinking. At the heart of the fear, well documented by media articles and reports (the New York Times, 2019; Corriere della Sera, 2019; Pew Research Center, 2012), is the perception for those who define themselves as middle class that the difficulty to maintain previous standard of living is significantly rising.

At the same time, the rapid growth in the economies of the emerging countries like China, Brazil and Russia has been accompanied with an increasing research on the possible expansion of the middle class in these parts of the world (MacLennan and Magalhães, 2013).

However, as reported by many authors (Gornick and Jäntti, 2013; Reeves et al., 2018), there is no consensus on the definition of the middle class and different definitions have been developed for different purposes and countries at different stages of social and economic development.

The goal of this paper is to provide a review of the heterogeneous definitions of the middle class adopted by the economic literature, examining the rationale for the various definitions and illustrating their implications in empirical analysis.

The paper is structured as follows. In the next section, the dominant income-based approach to measuring the middle class is briefly presented, discussing weaknesses and strengths of the different classifications. In Section 3 alternative methodologies for the analysis of the middle class drawn from polarization studies are proposed. Finally, Section 4 concludes.

2. The dominant approach: income classes and thresholds in the income scale

In spite of the wide acceptance of the sociological conceptualisations of class, in general economists in applied research opt for analysis based on a statistically measurable characteristic such as income[1]. On the one hand, this is for convenience, since data are most widely available and permit comparison across nations and over time. On the other hand, this is because this variable

[1] Some authors attempt to avoid the word "class" when focusing solely on income, aware that the term implicates to consider multiple dimensions and cannot be reduced to describe those households that fall in the 'middle' that is, in the middle of the income distribution (Gornick and Jäntti, 2013).

is a good proxy of living standards. Indeed, it tends to be highly correlated with the other characteristics associated with social class, such as economic security, education levels, and consumer preferences (Reeves et al. 2018). Disposable income - the amount of money that households have available for spending and saving after direct taxes have been accounted for - is generally the most widely used household/individuals income measure. It includes earnings from employment, private pensions and investments as well as cash benefits provided by the state.

In general, income groups to identify the middle class are chosen in two different ways. The first considers relative income thresholds based on the distance from a central tendency (the mean or the median income), or income distribution by percentile groups. The second opts for absolute income thresholds, which distinguishes income groups in relation to a clearly defined amount of income. Within this latter approach, Reeves et al. (2018) identify two classification subgroups that consider the distance from poverty or the absolute purchasing power.

However, since middle-class status may be closely linked to the possession of real and financial assets, some studies (Guiso et al. 2001; Jäntti and Sierminska, 2008; Atkinson and Brandolini, 2013; Sierminska et. al. 2013, Piketty, 2014) consider the distribution of wealth. For example, the study of Sierminska et. al. (2013) complements the income approach by providing information on wealth, aiming to capture the differences between income and wealth distributions, while Piketty (2014) defines "the middle class" exclusively in terms of wealth holdings. In particular, this latter author considers middle-class those households who have wealth holdings that fall between the top 10 per cent of the wealth distribution and median household wealth. However, the methodologies applied to identify the middle class do not differ from the definitions based on income. Moreover, they appear to be marginal in the literature since data on wealth tend to be of lower quality than data on income and are generally less comparable. Hence, the following paragraphs focus on income.

Table 1 reports the main definitions of middle class based on measures of central tendency, absolute thresholds and percentiles that will be discussed.

2.1 Definitions based on measures of central tendency

Within this income-based framework, one approach establishes an interval defined by percentages of median household income. Commonly middle class is identified with those households with an income between 75 and 125 per cent of the national median, as suggested by Thurow (1984), and adopted by Birdsall et al. (2000) and Pressman (2007).

Atkinson and Brandolini (2013) try to explain the rationale behind the choice of these limits. According to these authors, the lower cut-off is strictly related with the poverty threshold. Hence, they suppose that middle class members should be identified as those "who are not deemed poor by the standards of their countries" as in Ravallion (2010) or "those significantly above the poverty level" as suggested by Horrigan and Haugen (1988).

Since the relative poverty line is generally set as 60 per cent of the median of disposable income, an increase by 25 per cent is considered enough to define the "margins" of poverty. On the other hand, it is more difficult to explain the rationale behind setting the upper margin at 125 per cent of the median income apart from its symmetry with the lower threshold. Indeed, "the middle class range is in fact relatively short in proportionate terms" and a third or more of the population in many countries over time would falls in the "upper class" which seems unrealistic (Atkinson and Brandolini, 2013). Therefore, in their study these authors propose to divide the population into five groups: the "middle class" (between 75 and 125 per cent of the national median), the "lower middle class" (between 60 and 75 per cent) and the "upper middle class" (between 125 and 167 per cent). The upper threshold of this latter group is fixed at 167 per cent of the median income because "by taking the 125 per cent cut-off to be a quarter less than the

income level that identifies the rich, then the implicit richness line would be equal to 167 per cent of the median" (Atkinson and Brandolini, 2013).

Table 1. Income-based definitions of the middle class.

Authors, years	Middle income			Reference area
	Lower MI	Middle MI	Higher MI	
Based on a central tendency (median)				
Thurow -1984; Birdsall et al. - 2000; Pressman -2007		75–125		USA; 30 countries; 11 developed countries (LIS)
Atkinson and Brandolini, 2013	60–75	75–125	125–167	15 developed countries (LIS)
Blackburn and Bloom -1985		60–225		USA
Frick and Grabka -2013		70–150		Germany
Kristjánsoon and Ólafsson -2013		75–150		Iceland
Vacas-Soriano and Fernandez-Macias - 2017		75–200		EU
Chauvel -2013	75–125	75–250	150–250	Italy, France, Norway, USA
Alichi et al. -2016		50–150		USA
Vaughan-Whitehead, 2016	60-80	80–120	120–200	EU members
Whelan et al. - 2016	75-125		125-166	
Salverda and de Jong -2017		60–200		Netherlands
OECD, 2019	70-100	100–150	150–200	OECD members
Definitions based on an absolute threshold				
D'Agostino - 2012		$20,000–200,000, 2010 PPP		USA
Rose - 2016	$30,000–50,000	$50,000 –100,000, 2014PPP	$100,000 - 350,000	USA
Milanovic and Yitzhaki - 2002		$12–50 a day, 2000 PPP		119 countries
Kharas and Gertz - 2010		$10–100 a day, 2005 PPP		Developed and developing c.
Kochar - 2015		$10–20 a day, 2011 PPP		Developed and developing c.
Banerjee and Duflo - 2008		$2–4/$6–10 a day, 1993 PPP		13 developing countries
Ravallion - 2010		$2–13 a day, 2005 PPP		Developing countries
Birdsall - 2010		$10 a day, 2005 PPP - 95th percentile		Developed and developing c.
López- Calva and Ortiz-Juarez - 2011; Ferreira et al. - 2012		$10 –50, 2005 PPP		Chile, Mexico, Peru; Latin American countries
Definitions based on percentiles				
Levy – 1987; Partridge – 1997		quintiles 2–3		USA; USA; developed and developing countries
Barro – 1999; Easterly -2001		deciles 2–8		Developed and developing c.
Alesina and Perotti - 1996; Deininger and Squire - 1996; Dallinger - 2013		quintiles 3–4		71 countries; developed and developing countries
Solimano - 2008	deciles 3–6		deciles 7–9	Developed and developing c.

Different intervals have also been used, but many authors do not fully motivate the reasons for the solutions adopted and intervals are often postulated in an ad hoc manner.
For example, in one of the first studies in this field, Blackburn and Bloom (1985) select a middle-income range of 60-225 per cent of the median to examine the size and characteristics of the middle class in the United States from 1963 to 1983.

Frick and Grabka (2013) choose 70 to 150 per cent of median income, whereas Kristjánsoon and Ólafsson (2013) select 75 to 150 per cent of median income in their study on Iceland. Chauvel (2013), taking into account the work of Pressman (2007) and Atkinson and Brandolini (2013), selects 75 to 250 per cent but considers that the middle class is not homogeneous and divides it into "lower" (75 – 125 per cent of the median) and "upper" (150 – 250 per cent) segments. Vanneman and Dubey (2013) use 50 to 200 per cent in their study of India where the distribution is very skewed. Davis and Houston (1992) and, more recently, Alichi et al. (2016), define "middle-income households" as those with an income falling in an interval ranging from 50 to 150 per cent of median income, while the Eurofound (Vacas-Soriano and Fernandez-Macias 2017) proposes a range between 75 and 200 per cent of the median monthly equivalent net income of households.

A research promoted by ILO to investigate the evolution of the gap between the middle class and the bottom and the top in Europe opts to retain the lower threshold. In this study, the cut-off point is fixed at 60 per cent of median income, "in order to match the low pay threshold used by the European Union (fixed at two-thirds of median income by the Council of Europe)" (Vaughan-Whitehead, 2016). As the upper bound, the researchers select 200 per cent of median income, which corresponds to the top 5 per cent richest household. The middle class between these two extremes is then distinguished in three categories, the lower middle class (60-80 per cent of median income), the core middle class (80-120 per cent) and the upper middle class (120-200 per cent of median income). Similarly, Whelan et al. (2016) explore the relationship between income class and social class defining lower middle class as the ones between 75-125 per cent of median income and the upper middle class as those with an income between 75-125 per cent of median.

Salverda and de Jong (2017) study the position of the middle class in the Netherlands defining the middle class as those above 60 per cent of median household income (the relative poverty threshold often used in Europe) and below 200 per cent of that median.

The OECD methodology identifies middle-incomes as the population living in households with incomes ranging between 75 per cent and 200 per cent of the national median (OECD, 2016; 2019). A recent OECD report (2019) provides an in-depth focus on the current situation of the middle class as an economic and social group. For some of the analyses, it further divides the middle-income class into three groups: lower middle-incomes (75 per cent to 100 per cent of median), middle middle-income (100 per cent to 150 per cent of median) and upper middle income (150 per cent to 200 per cent of median). The population in households with income below 75 per cent of the median are consequently defined the "lower-income class" and those with income above 200 per cent of the median are the "upper-income class". Robustness checks that compare different alternatives in this study indicate "that country rankings show little variation when using different thresholds based on proportions of median income" (OECD, 2019) and this would seem one of the reasons to prefer middle class indicators based on median incomes. On the other hand, if one of these alternative intervals leads to contradictory results, this would surely weaken the range-specific evidence. Atkinson and Brandolini (2013) show this latter evidence in their analysis of fifteen countries around 1985 and 2004 using the Luxemburg Income Study database. By using different thresholds, they find that the variation in the share of the middle class observed in Italy and Sweden changes of sign as the upper cut-offs is raised.

Furthermore, the same disadvantage characterising relative poverty measures emerges, i.e. the so-called "identification problem" in Sen's (1979) classification scheme (Foster and Shorrocks, 1988). It means that the values of upper and lower boundaries separating the middle class individuals from the others can be justified differently, with an element of arbitrary choice either way.

However, a significant advantage of this kind of measures is that the size of each group is sensitive to changes in the distribution of income, both in terms of growth and in terms of changes in the underlying dispersion of the distribution (Cruces et al., 2011). Furthermore, this family of definitions permits stable comparisons of the income share and the size of each groups over time and cross-country.

2.2 Definitions based on absolute thresholds

Other economic definitions of middle-income strata are based on absolute thresholds. They can consider the distance from absolute poverty threshold - typically defined as a monetary cut-off point set at subsistence level which is in turn set at the value of goods and services (the consumer basket) necessary for satisfying essential needs and meeting mandatory payments - or other cut off points based on the absolute purchasing power.

Strengths of this approach are its consistency with the measurement of poverty and the fact that indicators based on absolute amounts are intuitive and easily understandable by the public.

However, the application of these criteria is also questionable since various lower and upper bounds are possible.

First, the boundaries of income groups depend on the specific contexts and the nation's stage of economic development that make international comparisons only partly relevant. Second, as reported by Pressman (2015), in some cases authors define middle-class income range not considering the official poverty line. For example, D'Agostino (2012) identifies the United States middle class as those households whose income ranges from around $20,000 to around $200,000 when the official poverty line for a family of four in 2010 was over $21,200. The same problem concerns international comparisons since a definition of middle class consistent across a comprehensive number of countries would implicate the use of very low absolute thresholds also in upper-middle income countries. This means that a high proportion of poor households would be included within the middle class definition.

Third, some differences emerge also in the analysis of the same context. Looking at the United States, on the one hand Rose (2016) defines the lower middle class and the middle class as those with household incomes between $30,000 and $100,000 - five times the poverty level - (family-of-three equivalent income) 2014 dollars. On the other hand, Holzer (2017) finds appropriate a minimum threshold of $50,000 a year for those aged 25-54, because it is twice the official poverty line for a family of four.

Definitions based on absolute thresholds are adopted in a growing number of works on the evolution of the global middle class. It is usually identified with the worldwide aggregation of the population of developed and developing countries - for which data are available - who are endowed with a sufficient high purchasing power to be able to buy a certain set of goods and services (Kharas, 2017).

In order to estimate the global middle-class, the most widely applied measure of this kind has been proposed by Milanovic and Yitzhaki (2002) who count as middle class individuals living with a per capita income on $12-50 a day, in 2000 purchasing power parity terms (PPP). These thresholds are established on the basis of the mean per capital income level in Brazil (lower bound) and Italy (upper bound), the least wealthy among G7 members. Their analysis is on the

national income expenditure distribution data from 111 countries and tries to count the "global middle class". With a similar methodology, Kharas and Gertz (2010) choose a range of $10 and $100 daily expenditure per person in 2005 PPP terms, excluding those individuals who would be considered poor in Portugal and Italy and rich in Luxemburg (the poorest and richest among the industrialised countries, respectively).

These latter values are gaining acceptance among economists. Similar threshold are applied by the World Bank (2007), researchers at the OECD (Kharas, 2010), academics (Birdsall, 2010; Birdsall et al., 2013, and Dadush and Shaw, 2011) and the private sector (Court and Narasimhan, 2010). As reported by Kochar (2015), who defines middle class the people who live with $10-20 a day, which translates to an annual income of $14,600 to $29,200 for a family of four in PPP 2011, this shows that there is a significant consensus on the lower bound to identify the global middle class. This is because the $10 threshold, almost five times above the poverty line, is associated with economic security and with a very low risk for people from falling back into poverty.

In particular, Birdsall (2010) uses a hybrid definition and includes in the middle class those with an income between $10 a day (in 2005 PPP) and at or below the 95th percentile of the income distribution. She argues that $10 a day implies a minimum level of economic security, relatively high if compared to the global poverty line of $1,25 a day, though still low by OECD standards. On the other hand, the relative maximum aims to exclude that portion of the population relatively rich in its own society. However, as reported by the author:

> "the 95th percentile is as arbitrary a cut-off at the top as is $10 at the bottom in defining a country-based indispensable middle class. There is no empirical basis to assume in any particular country that a household at the 96th percentile of per capita income or consumption is more reliant on income from capital or privileges or "rents" broadly speaking than a household at the 94th percentile; in fact in low-income countries the relevant cut-off at the top may be much higher, as income/consumption per capita even at the 95th percentile is still below $10 a day (for example in Ghana and India - more on India below)" (Birdsall, 2010).

Moving to a developing countries perspective, where analysis of absolute living standards are more widely used, a definition of the middle class based on absolute bounds seems more suitable (OECD, 2019).

Banerjee and Duflo (2008) consider as middle class all the households whose daily consumption per capita is between $2 and $4 or between $6 and $10, valued at PPP. Ravallion defines a "developing world middle class" as those "who are not deemed poor by the standards of developing countries but are still poor by the standards of rich countries" (Ravallion, 2010). He fixes a range of incomes between the median poverty line of 70 countries in the developing world ($2 per day at 2005 PPPs) and the US poverty line ($13 a day at 2005 PPPs).

Some studies for the Latin American and Caribbean (LAC) regions attempt to develop a more robust definition anchoring the income-based definition on the notion of economic security. Following a regression-based approach, López- Calva and Ortiz-Juarez (2011) and Ferreira et al. (2012) consider the probability of falling into poverty over at a five-year horizon of 10% to define the lower threshold and the structure of the data for the upper threshold. Their analysis yields to a LAC-specific range for the middle class from 10$ to 50$ in 2005 PPPs per day.

2.3 Definitions based on percentiles

Another very common approach to identify the middle class is based on percentiles of the income distribution. Generally, population is divided into five or ten parts by income to produce quintiles or deciles. The middle class can then be defined as some combination of these fractions. Definitions go to the narrowest that consists only of the middle quintile to the widest that define the middle class as the middle three quintiles of the family income distribution such as in Levy (1987) Partridge (1997) and Barro (1999).

Easterly (2001) identifies the "middle class" as those lying between the 20th and 80th percentile on the consumption distribution. Other studies (Alesina and Perotti, 1996; Deininger and Squire, 1996; Dallinger, 2013) restrict the definition of middle class to the share of the 3th and 4th quintiles of the population.

Furthermore, Solimano (2008) uses a relative-income definition of middle class that corresponds to individuals belonging to deciles 3 to 9. This can be broken in two subcomponents, a lower-middle class, corresponding to deciles 3 to 6, and an upper-middle class, corresponding to deciles 7 to 9.

In this context, the use of the size of the middle class as a measure is pointless since the share of households in the middle class is fixed over time. This means that for every household that moves into the middle class, another must move out—either rising into a higher class or falling into a lower one. Consequently, the share of income received by the middle class is considered as an alternative indicator.

The advantages of this approach include its simplicity and its consistency over time. Moreover, it eliminates the distorting effect of outliers. As underlined by Piketty (2013) the study of deciles and quintiles, with some caution, allows to compare distribution in different societies (as different as "France in 1789 and the United States in 2011") simply estimating the shares of national wealth and income going to each group. However, its strength is also its major drawbacks: because the share of the population in the middle class is fixed, shifts in the shape of the income distribution itself tend be lost (Reeves, 2018).
As pointed out by Foster and Wolfson (1992)

> "any symmetric distribution will have the same 'size' of the middle class irrespective of whether the incomes range widely or fall within one dollar of the median income. The fact that the income range necessary to capture 60 per cent of the population may have to vary extensively (e.g. from $12,000 in the initial uniform distribution to $24,000 in the second) is totally ignored. Clearly this approach misses out on an important aspect of the distribution: its spread".

3. Avoiding arbitrariness: the endogenous approaches

The previous sections show that there is no consensus among economists on how the middle class ought to be defined. Different definitions yield different results, not comparable to each other. Polarization approaches respond to the need for less arbitrary analysis of the middle class without explicitly defining it. Hence, the notion of economic polarization is frequently used to describe the processes of changes in income distribution, which occurs when there is a tendency to concentrate in the tails, rather than the middle, of the income distribution.

Two different strands of research are observable within this field. The first is the parametric approach, which assess income polarization changes developing quantitative measures called polarization indices (Panek and Zwierzchowski, 2020). The second approach uses kernel density estimation and mixture models in order to describe changes in polarization

patterns over time and cross-country (Clementi and Schettino, 2013). These approaches have the advantage of looking at the evolution of the middle class without distinguishing between income classes chosen a priori. However, their limits are related to the greater complexity of these methodologies compared to the standard ones and to the fact that they can provide useful information only in terms of comparison between two different distributions. Moreover, as reported by Gigliarano and Muliere (2012), they have been developed to measure the phenomenon of polarization that looks outside the middle class and, only indirectly, consider the middle.

In the next sections, these alternative methodologies, suitable to compare the middle class across two different distributions, are shortly described.

3.1 Polarization indices

Starting with the contributions of Foster and Wolfson (1992), Esteban and Ray (1994), and Wolfson (1994, 1997), different range-free methods to measure the middle class and polarization have been conceptualised (Wang and Tsui, 2000; Chakravarty and Majumder, 2001; Zhang and Kanbur, 2001; Anderson, 2004; Duclos et al., 2004; Esteban et al., 2007; Chakravarty and D'Ambrosio, 2010).

In these studies polarization is related to, but distinct from, inequality as demonstrated by Esteban (2002), Duclos et al., (2004), and Lasso de la Vega and Urrutia (2006). Indeed, inequality considers the overall dispersion of the distribution, whereas polarization measures aim to explore whether it is possible to observe "the appearance of groups in a distribution" (Chakravarty, 2009) and to capture the gap between those at the top and those at the bottom of society in developed and developing nations. This is due to the grouping of community members around more than one pole and their consequent distancing from the middle, according to specific characteristics.

The systematic classification of Esteban and Ray (2012) distinguishes two different approaches to conceptualise and measure polarization. The first approach considers polarization as the process by which a distribution becomes bi-polar. It measures the division of a society into two groups with the median value as a cut-off. Indices of this family are developed in Foster and Wolfson (1992), Wolfson (1994), Wang and Tsui (2000).

The second approach assumes that there may be an arbitrary number of groupings (or poles) in a distribution. It was proposed by Esteban and Ray, and it was fully axiomatised by Duclos et al. (2004) in the case of continuous distributions, and by Esteban and Ray (1994) in the case of discrete distributions.

Bi-polarization measures

Many authors provide axioms for bi-polarization indices that consider polarization as the result of a distribution concentrated around two points at its tails. The methodology proposed by Foster and Wolfson (1992) looks at the dispersion of the income distribution from the middle toward either or both of the two tails, dividing the distribution in two income groups, one above and one below the median. Their method is based on the concept of "partial orderings" and first (and second) degree stochastic dominance. They identify two different aspects of polarization: the "increased spread" and the "increased bipolarity". The first is a movement away from the middle whereas the second involves an increasing concentration around each pole. With this tool it is possible to compare different pairs of curves, one for each population to analyse. If the estimated curves do not cross at any point it is possible to draw an unambiguous conclusion about the evolution of the middle class without fixing any income boundaries. Otherwise, only the information of the different income ranges that support prior definitions emerges.

A representative example of this method can be done reporting the graphical analysis proposed by Borraz et al. (2013) to compare the distributions of household income in Uruguay between 1994 and 2004. The results are reported in figures 1, 2 and 3.

Figure 1 represents the constructed 'M-curves' for 1994 and 2004 which are able to provide some evidence of the Uruguayan middle class not being restricted to any particular definition.

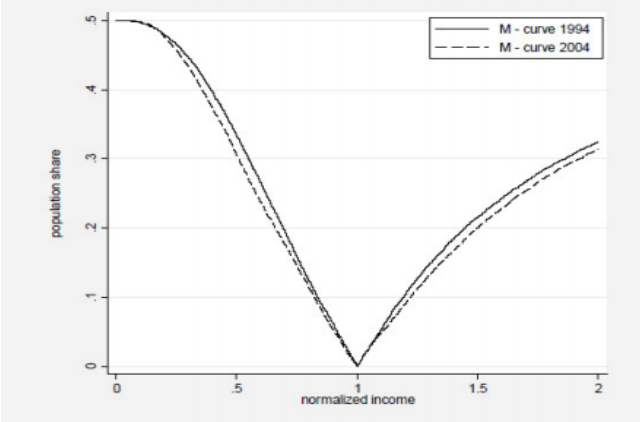


Figure 1. Evolution of the middle class. M-curve.
Source: Borraz et al., 2013

The M-curve is aimed at measuring the concentration of mass around the median of the income distribution: looking at different population ranges around the middle we can observe that the M curve of the income distribution of 1994 is always above the M curve of the income distribution of 2004. This means that the income distribution function in 1994 has a larger middle class than the income distribution function in 2004 as the former distribution attracts more mass around the median than the latter.

Figure 2 represents the 'first degree polarization curves' which plot the distance between the median and the median normalised income of the person at the qth percentiles. The normalised distribution function of 2004 has a greater spread near its median than the one of 1994 reflecting an increased bipolarity across the major part of the distribution.

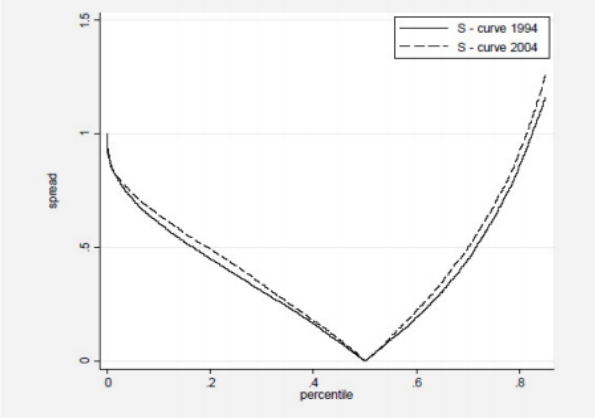


Figure 2. Evolution of polarization. S- first degree curve.
Source: Borraz et al., 2013.

Similarly, the 'second degree polarization curves' in Figure 3, according to Foster and Wolfson (1992), reveal that for any middle class population Q, the average distance of its members' incomes from the median (in terms of medians) is higher in 2004 than in 1994.

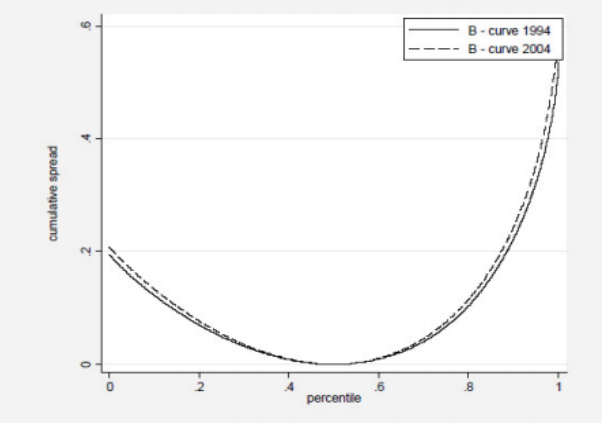


Figure 3. Evolution of polarization. B- second degree curve.
Source: Borraz et al., 2013.

With the help of these curves, we have graphically depicted many aspects of the distribution related to the evolution of the middle income groups, identifying a squeezing middle class and a wider distance between poles in 2004 than in 1994.

Foster and Wolfson also derive a synthetic index of bi-polarisation similar to the Gini index. It reflects the fact that, on the one hand, an increment in inequality between the two groups raises polarization but, on the other hand, an increment in inequality in each group decreases polarization. The authors apply their methodology to assess the evolution of the middle class to income and earnings data from the US and Canada (Foster and Wolfson, 1992). Alternative way of measuring of bi-polarization are proposed by Wang and Tsui (2000), Bossert and Schworm (2008) and Chakravarty and D'Ambrosio (2010).

General polarization measures

On the other hand, Esteban and Ray (1994), and Duclos et al. (2004) propose a set of axioms for general polarization measures, where polarization is understood as a tendency of a distribution to concentrate around a certain number of points, not necessarily two. This notion of income polarization is more general since it regards the latter as "clustering" of a population around two or more poles of the distribution, irrespective of where they are located along the income scale. As reported by Clementi et al. (2017), the notion of income polarization in a multi-group context aims to capture the degree of potential conflict inherent in a given distribution (Esteban and Ray, 1994). According to this framework, society can be considered as an amalgamation of groups, where the individuals in a group share similar attributes with the other members (i.e. have a mutual sense of "identification") but in terms of the same attributes they are different from the members of the other groups (i.e. have a feeling of "alienation"). Indeed, the coexistence of a high level of homogeneity within each group and a high level of heterogeneity between groups can generate social tensions, revolution and revolt, and social unrest in general.

Indices regarding the concept of income polarization as conflict among groups have been investigated by many authors (Gradín, 2000; Milanovic, 2000, Zhang and Kanbur, 2001; Duclos et al. 2004; Garcia-Montalvo and Reynal-Querol, 2002; Lasso De La Vega and Urrutia, 2006, Esteban et al., 2007; Gigliarano and Mosler, 2009). In some cases polarization indices require a pre-

grouping of the incomes in order to be computed (e.g. Esteban and Ray, 1994; Esteban et al., 2007). In others, the number of groups are determined endogenously (e.g. Duclos et al., 2004). In both cases, computing and comparing polarization indices is useful in characterizing some sort of stylized facts of the overall income distribution at one period.

Moreover, as suggested by Cruces et al. (2011), the definition of groups based on the polarization literature can be adopted to provide, as a by-product, a methodology to identify lower, middle and upper class with the calculus of the optimal income boundaries to separate each group from the others. The main advantage of this exercise is that the values of income boundaries are determined endogenously by the shape of the income distribution and the resulting groups are derived from theoretically defined concepts such as "identification", "alienation" and effective antagonisms. The chosen income thresholds are those that best distinguish the groups, to minimise internal differences within income groups and, as a result, maximise differences between these groups. Cruces et al. (2011), Ricci (2016) and Neri and Kakwani (2017) apply this procedure to identify the middle class respectively in six Latin American countries, Italy and Brazil.

To get an idea, Figure 4 by Cruces et al. (2011) reports middle class thresholds calculated on per capita income distribution in Argentina in 2000 according to different definitions. Four graphs display the results for some of the definitions of the middle class presented in Section 2. On the contrary, the lowest graph on the left reports cut-off thresholds that are identified non-parametrically using kernel density procedures with the process of Esteban, Gradín and Ray (2007), fixing at 3 the number of groups.

The empirical application of Cruces et al. (2011) comparing results for different countries and years shows that the definitions based on polarization measures have a number of additional advantages over the most frequently used income-based definitions of the middle class in the empirical literature. For instance, they result in more stable poverty patterns for the middle class for all countries and present a lower degree of volatility in middle-class size and income shares.

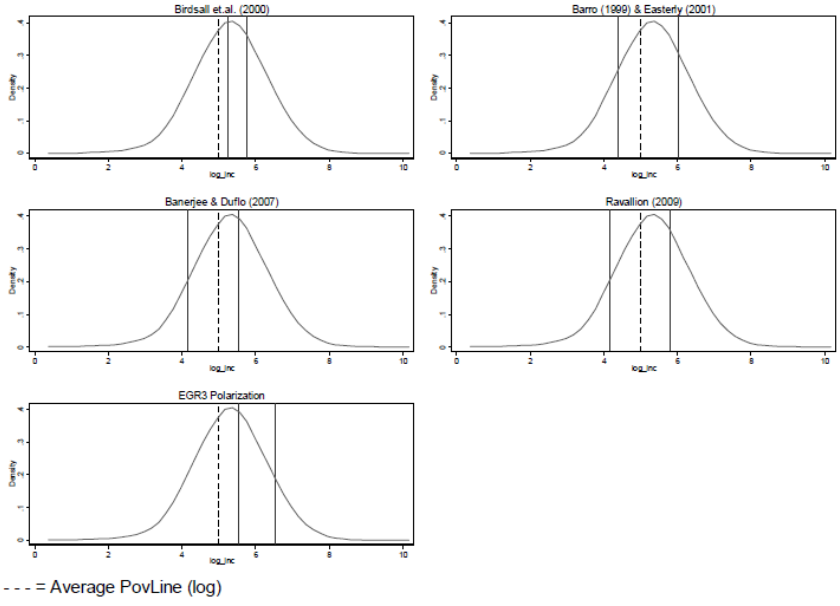


Figure 4. Comparison of different middle class cut-off points. Distribution of per capita income – Argentina, 2000[2].

[2] According to the authors "Birdsall et al. (2000) represent the definitions based on the measures of central tendency; Barro (1999) and Easterly (2001) correspond to those based on quantiles; and Ravallion (2009) and Banerjee and Duflo

3.2 The relative distribution approach

The so-called "relative distribution" approach is a non-parametric method that combines the strengths of summary polarization indices with the details of distributional change offered by the kernel density estimates. Many authors employ this tool to assess the evolution of the middle class and the degree of household income polarization in a number of middle- and high-income countries in the world.

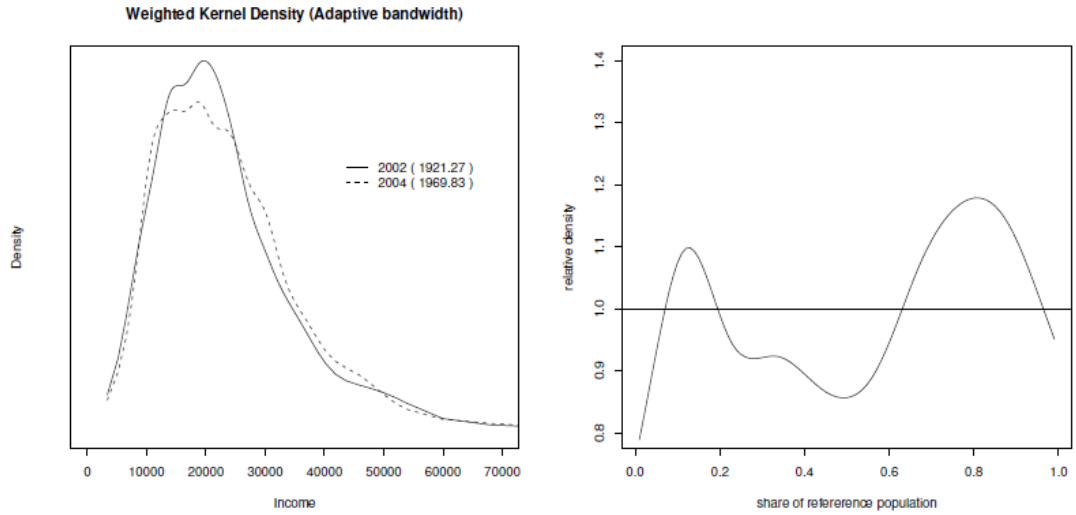
The pioneering study in this field is by Jenkins (1995) who suggests an estimation method based on a Kernel density approach, looking directly at the changes in the relative concentration of people at each income level over time. Handcock and Morris (1998, 1999) further develop this theoretical framework. Their "relative distribution method" assumes two populations, the "reference" and the "comparison" population, permitting to return the fractions of the "comparison" population that fall in each quintile of the "reference" population. In this way, it is possible to test hypotheses about distributional differences and, using decomposition techniques, to isolate the impact of changes in population mix (a demographic process) from changes in attribute allocation (a social or economic process). Hence, shifts can be due to differences in location (an equal absolute subtraction or addition to all incomes that moves the overall distribution either to the left or to the right) from shifts due to differences in shape, the "pure" distributional features changes which, by definition, are independent of location shifts.

Furthermore, this method combines the graphical tools of exploratory data analysis with statistical summaries, decomposition, and inference. On the one hand, it can generate simple graphical displays of results, giving a precise idea on to which extent and how income distribution changed in the considered period. On the other hand, this method permits the researcher to examine several hypotheses regarding the origins of distributional change (Khan et al. 2017).

Massari et al. (2009) apply this method to obtain some interesting findings on the evolution of the Italian middle-income class. Borraz et. al. (2013) and Alderson and Doran (2013) use the same methodology to analyse the evolution of the middle class in Uruguay and in nine countries for which suitable data are available in the LIS database, respectively. Clementi and Schettino (2013) apply this tool to identify patterns of changes in Brazil's household income distribution, Nissanov and Pittau (2016) measure changes in the Russian middle class over more than 10 years. Clementi et al. (2017) apply this technique to explore the "non-consolidation" of the middle class in Nigeria, Khan et al. (2017) use it to assess the evolution of the middle class and the degree of household income polarization in China.

For the purpose of a more intuitive understanding, Figure 5 reports the kernel density estimates for Italian income distributions in 2002 and 2004 by Massari et al. (2009).
The 'relative density function' reported in the second panel of the figure directly compares the two densities. It represents the ratio of the income density in the comparison year to the income density in the reference year evaluated at each percentile of the income distribution. It can be interpreted as the fraction of individuals in the comparison population that fall in each reference income percentile. This means that when the fraction of the comparison population in a percentile is higher (lower) than the fraction in the reference year, the relative distribution will be higher (lower) than 1. When the relative density has a value of 1.0, it indicates there has been no change at that point on the distribution over the period under consideration.

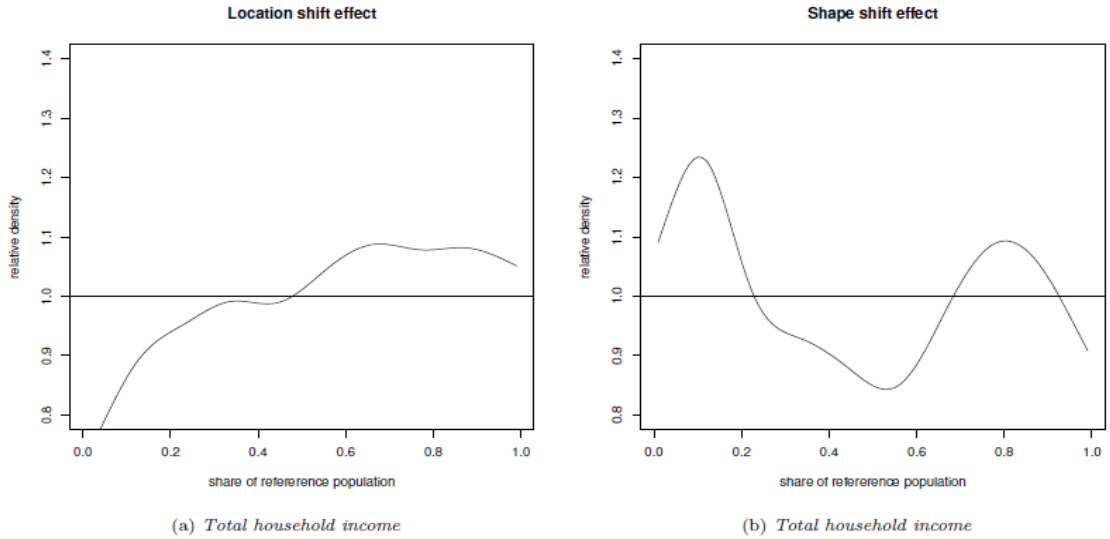
(2007) are used to illustrate measures based on absolute thresholds", Cruces et al. (2011). Note: some reference years can be different that the ones reported in Section 2.



(a) *Total household income* (b) *Total household income*

Figure 5. Comparison between 2002 and 2004 income distributions.
Source: Massari et al., 2009.

In this way it is possible to observe a clear shrink of the number of people at the centre of the income distribution, those between the 20th and 64th percentile rank in the reference year 2004. This means that considering any percentile between these values in the 2004 distribution, the fraction of households in 2002 that earn an amount of income corresponding to the chosen percentile is higher than the analogous fraction of households in 2004.



(a) *Total household income* (b) *Total household income*

Figure 6. Location effect and shape effect.
Source: Massari et al., 2009.

Figure 6 reports the decomposition of the relative distribution into location and shape effects. The first panel represents the effect associated with changes in the median of the income distribution. The location effect increases the share of households in higher percentiles, decreasing those in bottom percentiles. The effect imputable to the higher median is dropped

when we consider the shape component displayed in the second panel. The main important evidence is that a shrinking middle class is observable, with a significant loss of recent households in deciles 2 through 7.

At the bottom of the distribution, however, it is noticeable to observe an opposite effect from the location shift: operating by itself, the shape effect would have significantly increased the number of individuals in the lower deciles.

Also in this part of analysis summary measures are important tools for the comparison of distributional change: the link between what we have observed in the graphical analysis and the quantification of the degree of polarization is yielded by the median relative polarization indices (MRP) for the relative distribution.

The MRP is able to be divided into the contributions made by components above and below the median of the relative distribution as reported in Table 2.

The 95% pointwise confidence intervals for the MRP index and the LRP and URP indices are indicated for the null hypothesis of no change with respect to the reference year (i.e. that the index equals 0).

Table 2. Polarization indices.

Index	Value	95% Confidence Interval		p-value
MRP	0.0370***	0.0105	0.0635	0
LRP	0.0616***	0.0248	0.0983	0
URP	0.0124	-0.0258	0.0505	0.26

Source: Massari et al., 2009.

The estimated polarization indices reveal a significant and positive polarization at both the median and lower parts of the distribution. The first values can be interpreted as a 3,7% of the population shift from the median of the distribution to upper or lower positions. The lower indicator is larger, indicating a greater spread in the lower tail of the distribution than in the upper tail (see Massari et al. 2009).

4. Conclusions

The concept of "class" requires the examination of multiple dimensions. Nevertheless, the majority of economic studies only consider relative definitions and use the term "class" addressing a stratum of the income distribution rather than an analysis of the notion "class". In particular, this is very common in the empirical research aimed at identifying and measuring the middle class and its evolution over time as it often ignores the important contributions of sociologists and classical economists. As reported by Vaughan-Whitehead (2016), this approach has been widely criticised for the "one-shot" approach that does not consider the roots of their middle-income positioning. In particular, many authors (for example Goldthorpe, 2000, 2010) argue that it is also crucial to consider class positions as resulting from social relations in economic life or, more specifically, from relations of employment. Nevertheless, middle class also refers to social status, meaning place in a social hierarchy based on life opportunities, life-styles and attitudes (see Bourdieu 1984, 1987).

Furthermore, conventionally adopted approaches in economics lead to different picture of change over the years of the evolution of middle as results depend on the definition considered.

The first aim of this paper was to provide a review of the most widely used income-based measures to analyse the evolution of the middle class in economics, considering its limits and the necessary integrations (Atkinson and Brandolini, 2013).

What emerges from the different studies is that that the primary basis for selecting an approach to income stratification is the country's level of development. While research in well-developed and high-income countries requires the application of relative income thresholds that correspond to their average standard of living, it is more common in countries with lower income to adopt an absolute approach to stratification.

Nevertheless, the growing recognition of the role of the middle class as a stabilising force and the increasing attention to what is happening to the middle groups in the public debate raise the necessity to identify and compare middle class without any arbitrariness. For these reasons, Section 3 of this paper reviewed alternative and complementary methodologies for the analysis of the middle class, which try to avoid some of the definitional problems and are very useful to provide some stylised facts on the evolution of this group. In particular, the integrated framework provided by polarization studies - even if considering a single quantitative characteristic, such as income - displays many strengths to evaluate how the middle class has evolved. First, it enables comparisons of the size of the middle class over time that are not dependent on the choice of the thresholds that divide the middle class from other groups. Second, it provides additional information beyond traditional measures, obtaining a more comprehensive analysis of the evolution of the middle class over time.

Further research, carried out on the basis of micro-data, will empirically test the differences between the definitions, measurements and methodologies to identify the middle class in economics reviewed in this paper.

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