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Causal effects of socioeconomic status on central adiposity: Evidence using panel data from urban Mexico

Pierre LEVASSEUR

Abstract: *The current economic growth and increase in urbanization has led to the adoption of new lifestyles in middle-income countries such as Mexico. Associated with overweight, obesity and chronic diseases, the nutrition transition process reveals important socioeconomic issues. Using panel data from the Mexican Family Life Survey, the purpose of the study is to estimate the causal effect of household socioeconomic status (SES) on nutritional outcomes among Mexican adults from urban areas. We divide the analysis into two steps. First, using a mixed clustering procedure, we distinguish four socioeconomic classes based on income, education and occupation dimensions: (i) a poor class; (ii) a lower-middle class; (iii) an upper-middle class; (iv) a rich class. Second, using an econometric framework adapted to our study (the Hausman-Taylor estimator), we measure the impact of belonging to these socioeconomic groups on individual anthropometric indicators, based on the body-mass index (BMI) and the waist-to-height ratio (WHtR). Our results make several contributions: (i) we show that a new middle class, rising out of poverty, is the most exposed to central adiposity; (ii) as individuals from the upper class seem to be fatter than individuals from the upper-middle class, we can reject the assumption of an inverted U-shaped relationship between socioeconomic and anthropometric status as commonly suggested in emerging economies; (iii) the influence of SES on anthropometric indicators appears to be particularly strong for men.*

Key-words: *anthropometric indicators; central adiposity; clustering method; Mexico; middle-income countries; nutrition transition; obesity; overweight; socioeconomic status.*

1. Introduction

Brought on by rapid economic growth and urbanization, the nutritional and epidemiological transition process is closely linked to the level of development of the country concerned. While undernutrition and infectious diseases are still fairly common in poorer economies, middle-income economies receive the full impact of this transitory pattern of nutrition associated with overweight, obesity and chronic diseases (Popkin and Gordon-Larsen, 2004). Several socioeconomic issues determine this process. According to the health economics literature, the impact of socioeconomic status (SES) on nutritional patterns depends on the level of a country's development (Sobal and Stunkard, 1989). The relationship between obesity and SES appears to be negative in developed countries (despite differences in gender and age) (Costa-Font et al., 2014), whereas the opposite holds in the developing world (McLaren, 2007). In other words, overnutrition should affect low socioeconomic classes in rich countries and high socioeconomic groups in poor economies. Nevertheless, in middle-income economies (such as Mexico, Brazil, Egypt, South Africa, etc.) this relationship is not so clear. Monteiro et al. (2004a) observed a strong emergence of obesity among poorer inhabitants when economic activity increased. Moreover, the study by Monteiro et al. (2004b) shows a positive and significant relationship between obesity and income growth in poorer socioeconomic categories. Even if their incomes improve, poor people seem to have difficulty in getting relatively more expensive food with low energy content (fruit and vegetables) in their diet. Moreover, lower socioeconomic groups have limited access to nutritional education and fewer opportunities to pursue an active lifestyle (little free time) (Orden et al., 2005).

In the case of Mexico, Rivera and Sepúlveda Amor (2003) find a statistically significant negative relationship between SES and obesity. Therefore, in addition to income and recreational facilities, the upper classes appear to be better informed about nutritional and health behaviors recommended by specialists. Furthermore, focusing on the poorest quintile of the Mexican population, Fernald (2007) noted that overweight individuals were the most educated, had a better job and owned more material assets. Consequently, when we combine previous findings, the relationship between SES and obesity in Mexico appears to be non-linear. Some authors go even further by assuming an inverted U-shaped curve (Fernald, 2007). If this assumption is verified, the nutrition transition could most affect a new middle class rising from extreme poverty.

The literature, which analyses socioeconomic factors associated with the surge of weight gain in Mexico, remains incomplete in various ways. First, studies in social sciences use limited anthropometric indicators, such as the body-mass index (Burkhauser and Cawley, 2008),

which do not take into account the distribution of fat (central adiposity being the most associated with health complications). Second, these studies conducted cross-sectional procedures, which could provide biased results from causal relationships between socioeconomic and nutritional status. Third, none of previous studies investigates the socioeconomic heterogeneity of Mexican households using a multidimensional approach. Most of the time, authors study each component of SES separately. Consequently, despite the growing literature on the topic, results are often ambiguous and sometimes paradoxical, particularly for men.

Therefore, the main objective of our study is to improve upon the previous literature by identifying the causal influence of household socioeconomic classes on individual central adiposity, using Mexican panel data. In line with Bonnefond and Clément (2014), we use a two-step method: (i) we classify Mexican households according to their SES using a clustering method (based on household income and the education and occupation of the family head); (ii) we analyze the causal relationship between these socioeconomic groups and two anthropometric indicators: the body-mass index and an alternative indicator measuring central adiposity called the waist-to-height ratio. The analysis relies on panel data from the *Mexican Family Life Survey* (MxFLS), which provides three survey waves (2002, 2005-2006 and 2009-2012). Household clustering is based only on the first wave, whereas outcome variables are observed at several points in time in order to identify nutritional disparities between and within socioeconomic groups. Therefore we assume that socioeconomic clusters are time-invariant for the period (between 2002 and 2012), but that nutritional status of their members might change. The use of a time-invariant and endogenous explanatory variable (socioeconomic groups) in a panel model with a short time period (only three waves) constitutes the main challenge of this research.

The rest of the paper is organized as follows: section 2 establishes the theoretical framework of the research, section 3 presents the data and outcome variables, section 4 identifies the socioeconomic heterogeneity in urban Mexico using a clustering method, and section 5 provides the econometric analysis and comments on the results. Section 6 concludes.

2. Theoretical framework

2.1 A reduced form model

The objective of the study is not to estimate direct determinants of nutritional status (calorific intake, diet, nutritional knowledge, genetic factors, physical activities, etc.), but rather its indirect effects. Therefore, in accordance with Bonnefond and Clément (2014), the model takes a reduced form which is expressed as follows:

$$AI = F(SEC; OIF)$$

Where *AI* corresponds to anthropometric indicators in order to measure the nutritional status of individuals, *SEC* refers to dummies identifying the socioeconomic classes of households which come from the clustering procedure, and *OIF* combines other indirect factors of nutritional status that work as control variables in the model. They include characteristics relating to individuals (age, marital status, etc.), households (assets, number of members, etc.) and communities (infrastructure development, urbanization level, etc.).

2.2 Socioeconomic heterogeneity in Mexico

Despite the frequent use of SES in social and epidemiological sciences, some limits remain on the way to measure it. While there seems to be a scientific consensus on the multidimensional aspect of the SES, most studies analyze each dimension independently (Bradley and Corwyn, 2002).[1] Braveman et al. (2005) provide some clarifications on this issue. First, education and income components might not be interchangeable because the correlation between these variables is low. Not only can wages differ for similar levels of education and *vice-versa*, but education is also associated with many social characteristics that income cannot capture (nutritional and health knowledge, skills, personal fulfillment, prestige, critical faculties, etc.). Second, occupation provides valuable information on lifestyles and the place of the individual in society. However, according to these authors, the standard variable of occupation used in the literature (socio-professional categories) is generally inconsistent, especially in the context of developing countries. In these societies the labor market is usually dual, with on the one hand formal and regulated occupations, and on the other hand informal and deregulated activities (commonly less well paid). In addition, many informal occupations are not remunerated in developing economies, particularly where women are concerned.

Furthermore, taking into account important socioeconomic inequalities, the Mexican population is very heterogeneous (especially since the social disorder that resulted from the 1982 debt crisis). This heterogeneity has already been emphasized by the Social Research Institute (López Romo et al., 2012). After making a socioeconomic stratification into six groups, the study also shows the substantial connection between social class and nutritional and health behavior. Each class identified in the stratification is associated with particular lifestyle and eating patterns. In order to take into account these considerations, we opt for a more complete and comprehensive approach than one-dimensional procedures. In the same way as Bonnefond et al. (2015), we combine three main components of the SES and build a

[1] In our sample, analysing each dimension of SES separately provides ambiguous results and does not enable us to reach clear conclusions. Besides, the results are often non-significant.

qualitative and synthetic variable accounting for socioeconomic class which is able to capture the heterogeneity of the Mexican population. Several methods can be used, but most of them rely on the subjective weighting of variables. By contrast, clustering methods allow us to obtain objectively homogeneous and significant groups of households based on their socioeconomic characteristics.

3. Data and outcome variables

3.1 Data

All data used in this study come from the *Mexican Family Life Survey* (MxFLS), the first survey with a representative sample of the Mexican population at national, rural-urban and regional levels. Sampling directives were drawn up by the INEGI (The Mexican National Institute of Statistics, Geography and Computing). The survey covers a 10-year period with three distinct waves (2002, 2005-2006 and 2009-2012). The first wave was carried out in 2002 with 35,677 individuals surveyed in 8,440 households. These households lived in 150 communities across 16 Mexican states. Given the longitudinal dimension of the survey, the second and the third waves are based on the initial sample from 2002. For both waves, the reproduction rate of the initial sample exceeds 90% at household level (i.e. an attrition rate of below 10%). MxFLS data include detailed information on socioeconomic and demographic characteristics of households and individuals (very useful in identifying SES) and objective and high quality anthropometric data collected by the experienced staff from the INSP (The Mexican National Institute of Public Health).

Our sample is restricted with the aim of better observing the nutrition transition process in Mexico. First, rural areas (communities with fewer than 2,500 inhabitants) are excluded. Insofar as the majority of Mexican economic development has occurred through the urbanization process, lifestyles change considerably between rural and urban zones. Starvation and infectious diseases are still very apparent in rural areas, whereas townspeople are more affected by obesity and chronic diseases (Smith and Goldman, 2007). Second, pregnant women were withdrawn from the sample in order to limit anthropometric bias. Third, the analysis focuses only on the adult population (from 16 to 60 years old) because anthropometric indicators are poorly adapted to children (in addition few data are available). Moreover, as pointed out by Elia (2001), the data are difficult to interpret for older individuals (important morphological changes occur after 60 years old).

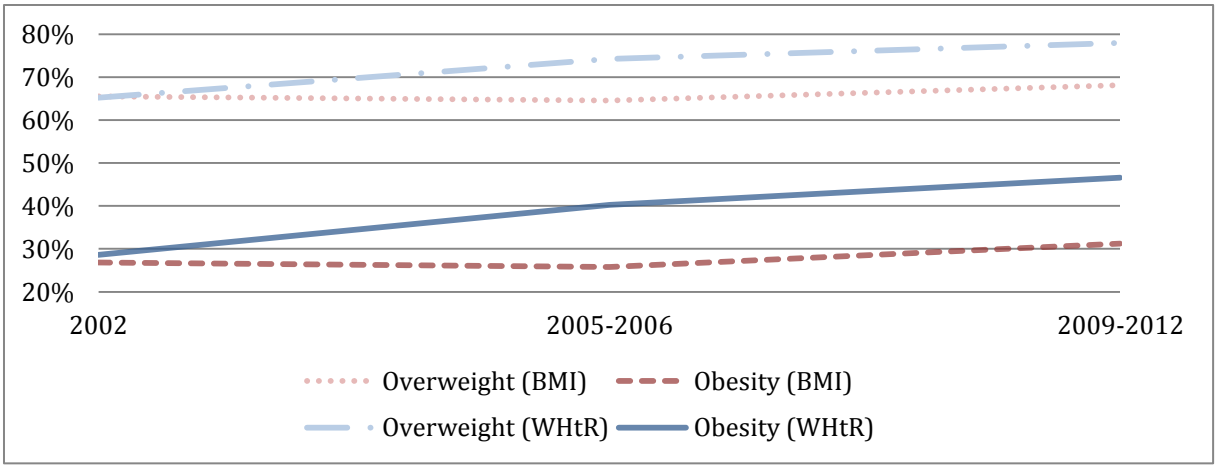
3.2 Anthropometric outcome variables

Given the lack of data, studies in social sciences were often forced to use the body-mass index (BMI) in order to identify the anthropometric status of individuals. Even if the BMI is

considered as a good indicator of general adiposity, it has been frequently criticized by the medical literature for not taking into account the quantity of body fat in the organism (Barquera et al., 2007). Burkhauser and Cawley (2008) identify two limits on the use of the BMI. First, it might underestimate the number of individuals for whom fat distribution could lead to major health problems. Second, it could be less accurate for certain groups of individuals. The BMI overestimates the adiposity level for some ethnic groups (such as Afro-Americans) and for men, since it does not distinguish between fat and muscle. For these reasons, health professionals suggest that the BMI should be associated with other indicators in order to identify the level of central adiposity (abdominal fat), such as percentage of body fat, waist and/or hip measurements, waist-to-height ratio (WHtR) or waist-to-hip ratio. Given the anthropometric data available from the MxFLS, we consider two outcome variables: (i) the body-mass index (BMI) and (ii) the waist-to-height ratio (WHtR). Descriptive statistics and correlations are reported in Tables A.1 and A.2 in the Appendix.

Focusing on our sample, Figure 1 compares overweight and obesity rates according to the BMI (higher than 25 and 30 for overweight and obesity respectively) and the WHtR (higher than 0.5 and 0.577 for overweight and obesity respectively). It is clear that the prevalence of obesity depends on the indicator used, especially since 2002. Based on the BMI alone, the prevalence of obesity in Mexico increased by 4 percentage points between 2002 and 2012, while, based on the WHtR, during the same period the obesity rate shot up by 18 percentage points (more than 45% in 2012). These alarming results accentuate the severity of the nutrition transition process that is occurring in Mexico. Several authors, such as Ashwell and Hsieh (2005), suggest that the BMI should be replaced by the WHtR as the international standard of overweight and obesity, because the latter is more efficient, easier to use and less expensive to collect.

Figure 1: Mean prevalence of overweight and obesity among urban Mexicans according to BMI and WHtR



Source: MxFLS (2002-2012)

4. Identification of socioeconomic heterogeneity in urban Mexico

4.1 Clustering procedure for identifying SES

As explained previously, clustering methods allow the socioeconomic heterogeneity of the Mexican population to be captured using a multidimensional perspective. More precisely, a mixed clustering procedure seems to be the most appropriate for processing large databases, in addition to combining the advantages of both types of classification (hierarchical and k-means clustering algorithms) and reducing their disadvantages significantly (Lebart, 2000) .[2]

The classification procedure is based on income, education and occupation dimensions. Frequencies are reported in Table A.3 in the Appendix. First, the income dimension corresponds to the household income during one year (income from work, assets and public and private transfers). This continuous variable is divided up into deciles in order to build 10 income classes.[3] Second, the highest level of school completed by the head of the household accounts for education with five distinct levels: (i) without instruction or never went beyond preschool; (ii) elementary school level; (iii) secondary school level (middle school); (iv) high school level and similar kinds of diploma (professional training and teacher training);[4] (v) higher educational level (graduate and postgraduate degrees). Third, the occupation dimension is captured using the main activity undertaken by the household head during the

[2] In the same way as Bonnefond et al. (2015), we cluster our sample using SPAD software. The algorithm works in four stages: (i) initial centroid groups are obtained at the intersection of several partitions based on the k-means algorithm; (ii) stable partitions are disaggregated by a hierarchical agglomerative clustering based on the Ward criterion; (iii) stable partitions are constructed by successive cuts in the hierarchy thus obtained; (iv) the procedure automatically seeks the best partitions by performing k-means iterations (consolidation step). After partitioning, the dendrogram (visual check of the hierarchy) and the level index histogram allowed us to determine the number of classes into which the sample had been divided.

[3] The income has been deflated in accordance with the consumer price index of each Mexican federal entity using data from the INEGI (available on http://www.inegi.org.mx/).

[4] Professional training refers to work training (minimum of 6 months) and technical and technological education (three years), whereas the teacher training system trains future teachers for elementary and secondary schools (7 years).

year preceding the survey. Six categories are distinguished: (i) inactive (retired individuals, students, sick individuals, invalids, people seeking employment, etc.); (ii) unpaid worker (homemaker, caregiver, family worker, etc.); (iii) informal worker (without written contract); (iv) employee with formal contract; (v) self-employed worker (and small farmer); (vi) employer.[5]

4.2 Results from the mixed clustering method

Based on the first six factorial axes, the clustering procedure reveals a socioeconomic stratification of Mexican society into four groups: (i) a poor class (group A); (ii) a lower-middle class (group B); (iii) an upper-middle class (group C); (iv) an upper class (group D). Table 1 compares frequencies of active variables to describe the main characteristics of each group. Table A.4 in the Appendix presents means and frequencies of several illustrative variables in order to analyze our four classes accurately. They bring together information about housing, assets, social transfers and characteristics and consumption patterns of household heads.

Group A, which represents 12.8% of the sample, is characterized by lower incomes (27% in the first decile). Heads of households seem to have a low level of education (predominantly uneducated and seldom going beyond elementary school) and an unfavorable working situation (35% are inactive: retired, student, sick, invalid, seeking employment, etc.). We can identify three subgroups of workers. The first includes employees with formal contracts from secondary industry (*maquiladoras* – subcontractors to multinational companies), craftsmen or small business (they represent 5% here). The second, characterized by even lower wages, constitutes the labor force of the informal economy. While some of them might work for informal micro-enterprises (20%), others are self-employed (21%) engaged in survival activities such as domestic services, street vending and displaying goods for retail sale directly in the street. The third subgroup is characterized by non-remunerative activities such as homemaker, caregiver or family workers (16%), generally women. In addition, illustrative characteristics strengthen the state of poverty and vulnerability which defines the group.[6] Our findings seem to agree with the literature. In accordance with the socioeconomic stratification suggested by Portes and Hoffman (2003, p.59), we could equate our group A with their "subordinated" class.

[5] The variable appears in this form in the survey. No detail is provided regarding contract formalisation of self-employed workers and employers.

[6] Although 87% of households own a house, this is not a symbol of wealth or socioeconomic prosperity in Mexico, unlike housing quality and value (Torche and Spilerman, 2009).

Table 1: Characteristics (active variables) of clusters

Active variables	Group A N=500 (12. 8%)	Group B N=1454 (37.2%)	Group C N=1298 (33.2%)	Group D N=659 (16.8%)	All N=3911 (100%)
Household income					
Decile 1	**27.0%**	10.7%	*6.7%*	*2.0%*	10.0%
Decile 2	11.4%	**19.1%**	*3.3%*	*2.0%*	10.0%
Decile 3	9.0%	**17.6%**	*5.8%*	*1.8%*	9.9%
Decile 4	10.6%	*7.8%*	**16.6%**	*1.5%*	10.0%
Decile 5	9.2%	*7.1%*	**14.6%**	*5.2%*	9.5%
Decile 6	*7.2%*	**11.7%**	**13.1%**	*5.3%*	10.5%
Decile 7	*7.4%*	*7.3%*	**16.6%**	*6.1%*	10.2%
Decile 8	*5.6%*	9.4%	**11.6%**	10.8%	9.8%
Decile 9	*6.6%*	*8.0%*	10.8%	**15.2%**	10.0%
Decile 10	*6.0%*	*1.2%*	*0.9%*	**50.2%**	10.0%
Household head's education level					
Without instruction	**66.0%**	*0.0%*	*0.0%*	*0.0%*	8.5%
Elementary	*23.4%*	**86.9%**	*7.1%*	*6.4%*	38.6%
Secondary	*5.2%*	*9.0%*	**59.8%**	*6.7%*	25.0%
High school and similar degrees	*3.6%*	*2.8%*	**30.8%**	*11.2%*	13.6%
Higher degrees	*1.8%*	*1.3%*	*2.2%*	**75.7%**	14.2%
Household head's occupation					
Inactive	**35.4%**	*0.0%*	*0.0%*	*1.8%*	4.8%
Unpaid worker	**16.4%**	**10.2%**	*1.0%*	*2.9%*	6.7%
Informal worker	*19.8%*	**41.6%**	*20.6%*	*5.6%*	25.8%
Formal employee	*5.0%*	*12.7%*	**59.2%**	**56.6%**	34.5%
Self-employed worker	21.0%	**30.1%**	*14.5%*	21.2%	22.2%
Employer	*2.4%*	5.4%	*4.7%*	**11.8%**	5.9%

Note: Bold values express significant and positive differences of each group compared to the total average, while italic values show significant and negative differences of each group compared to the total average. Others values do not have significant differences from the total average.

Source: MxFLS (2002).

Group B, which represents 37.2% of the sample, is defined by low-middle incomes (63% of income is distributed between the second and the sixth decile). The majority of heads of families have a primary education level (87%). While 5% are employers, some 42% appear to work for informal firms and 30% are self-employed workers (such as mechanics, fitters, carpenters, shoemakers, etc.). Even if on certain points, illustrative characteristics are slightly better than in group A, the common assumption that a middle class has risen from poverty is contrasted by the precarious nature of its occupations. In addition, poor accumulative opportunities associated with informal activities can limit socioeconomic improvement (OECD, 2010). Recently, in agreement with our results, Birdsall et al. (2014, p.132) identified this class on the edge between poverty and middle class status in Latin America. Given its precarious and vulnerable living conditions, these authors name this emerging and dominant class "the new poor" and also "strugglers".

Group C, which represents 33.2% of the sample, is characterized by upper-middle incomes (73% between the fourth and the eighth decile). The relatively better economic situation is not surprising insofar as 59% of family heads in this group are employed in formal institutions;

contract formalization is a great advantage in terms of social security and wages in Mexico (OECD, 2010). Even if 60% of them do not go beyond middle school (secondary), about 31% were in high school or similar levels (28.4% had obtained the baccalaureate or did technical training and 2.5% come from teacher training). Inspired by Portes and Hoffman (2003), we assume that this class is composed of tertiary and secondary employees with substantial qualifications and working in both private and public sectors (executive workers, technicians, teachers). Moreover, Portes and Hoffman (2003) explain that some skilled employees work without formal contracts in order to avoid the costs associated with working legally. This argument can explain why 21% of workers in this group have informal contracts. Given their illustrative characteristics, households from this class appear to have more comfortable living conditions than either of the previous groups. Therefore, group C may constitute the true Mexican middle class.

Group D, which represents 16.8% of the sample, has the highest incomes (76% between the eighth and the tenth decile) and the wealthiest living conditions (Table A.4 in the Appendix). Not surprisingly, some 76% of household heads have higher education levels: 95% of these have bachelor's degrees. While some 57% of family heads work as employees with formal contracts, almost 12% are employers. As suggested by Portes and Hoffman (2003), the Mexican rich class can be divided into three subgroups: (i) employers and suppliers of capital, generally owners of middle-sized and large businesses; (ii) senior managers of middle-sized and large businesses, private or public, and state institutions; (iii) higher skilled employees. We could add another subgroup in this class. It could be owners and managers of micro-enterprises, better educated and richer than the average Mexican, who are able to accumulate capital and to get rich (despite the fact that they have lower incomes than the rest of the class).

5. Econometric analysis

5.1 Econometric framework

As explained in the introduction, the econometric framework has to deal with several methodological challenges. First, our explanatory variable of interest (SES classes) is time-invariant and our panel sample is short (only three waves). Second, the variable of interest generates endogeneity problems for two main reasons. We can identify a potential selection problem for the reason that the error component might contain non-observable characteristics which explain socioeconomic and anthropometric status simultaneously. As mentioned in the literature, non-observed factors could be genetic and environmental characteristics as well as

individual preferences (Cawley, 2004; Devaux et al., 2011). Furthermore, the presence of reverse causality between the SES variable and outcome variables is also a source of endogeneity. Indeed, we can assume that overweight and obesity limit the socioeconomic opportunities of Mexicans in terms of access to education, employment and credit (Bastida and Pagán, 2002; Pedraza, 2009).

Meanwhile fixed effect models (*within* models) provide incoherent results with short panel data, they can only estimate coefficients of time-varying regressors. Random effect estimators (*between* models) might seem to be better adapted, but endogeneity problems lead us to use instrumental variables (Jones et al., 2013). Nevertheless, as the selection of instruments is the subject of much debate in the literature, hybrid estimators (combining *within* and *between* effects), such as that of Hausman and Taylor (1981), would appear to be better adapted. By contrast with random effect models with instrumental variables, the Hausman-Taylor estimator forms its own set of instruments with internal variables. As a consequence, we do not need to search for significant and valid external instruments (Jones et al., 2013). The Hausman-Taylor estimator assumes four categories of explanatory variables: exogenous and endogenous time-varying regressors and exogenous and endogenous time-invariant regressors.

In this study, exogenous time-invariant regressors are: (i) gender (dummy); (ii) Amerindian ethnicity of the household head (dummy);[7] (iii) whether the household received public transfers in 2002 in order to help with health, education, housing, saving, employment, credit and/or entrepreneurial investment (dummy);[8] (iv) the development level of the community in 2005.[9] The model also includes three continuous and endogenous time-varying regressors.

[7] In the same way as being a man, being an Amerindian can reduce the risk of weight gain. Bodyweight differences between men and women are mainly explained by gender inequalities (Chant, 2003), whereas the socioeconomic exclusion of indigenous communities and their traditional lifestyles could act as protective factors against obesity (Stoddard et al. 2011). However, gender and ethnic origin cannot be considered as a consequence of obesity. Therefore, we may reasonably assume that gender and ethnicity are exogenous variables in the model

[8] If one can suppose that the additional revenue from public aid can affect the corpulence of beneficiaries, it is also possible that the anthropometric status could have an impact on socioeconomic status. However, the eligibility for public aid is often based on the socioeconomic characteristics of individuals. Superficially, there could thus be a relationship between the eligibility for public aid and anthropomorphic status, these two components probably being correlated with poverty. Nevertheless, this relationship is considered to be too weak to be relevant, given that the government does not support people for their anthropometric characteristics. Moreover there is a temporal difference that renders this hypothesis unlikely: since the household receives the public money at time t, its weight could only vary at time t+1 whereas the household was considered eligible by the competent authorities at t-1. In view of this, we consider public support as exogenous.

[9] The development level of infrastructures among communities in 2005 is measured with a composite index that is equal to the sum of dummies (1 if the community has the infrastructure and 0 otherwise) for six kinds of infrastructure: (i) public transportation; (ii) health centre; (iii) public waste collection; (iv) public sewage; (v)

Two of them capture the wealth dimension of SES as suggested by Braveman et al. (2005):[10] (i) the number of members per room quantifies the housing demographic pressure; (ii) a composite index of household assets.[11] The third variable takes into account the influence of the media and the process of becoming more sedentary, counting the screen time (television and computer) for each individual (during the last week before each wave).[12] Finally, we consider various exogenous time-varying regressors. Four of them identify the main individual characteristics: (i) age; (ii) square of the age; (iii) marital status (in a couple, separated or single); (iv) smoking (dummy).[13] Two additional variables give information about the community environment: (i) whether the demographic concentration is higher than 100,000 inhabitants (dummy); (ii) north-south region (dummy). In addition, we include dummies for the survey year in order to analyze change in the nutrition transition process over time. Descriptive statistics and correlations are available in Tables A.1 and A.2 respectively in the Appendix. Furthermore, we perform a Chow test in order to verify the relevance of analyzing gender subsamples separately and a Sargan-Hansen test to check the validity of internal instruments processed by the Hausman-Taylor estimator.

5.2 Econometric results

Hausman-Taylor estimates are presented in Table 2 and confirm our main assumption. In fact, the SES significantly explains anthropometric status in urban Mexico (at the 1% and 5% levels for the WHtR and the BMI respectively).[14] As expected, we find differences according to gender, as being a man significantly reduces both anthropometric indicators. Moreover, the Chow test rejects the null assumption of structural stability between gender subsamples. While this break reflects the reality insofar as the prevalence of overweight and obesity is

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paved roads; (vi) a hydraulic pipeline system. We also consider the number of primary schools as an indicator of the development level of communities in 2005.

[10] According to these authors, wealth (assets, housing) is an important and non-substitutable factor of the household's SES insofar as: (i) wealth can compensate for the temporary loss of income; (ii) wealth reflects the household's power and its influence over others; (iii) wealth might vary a lot between different social groups with similar incomes.

[11] The composite index of household assets sums the six following dummies (1 if the household owns at least one unit of the asset kind and 0 otherwise): (i) property; (ii) second property; (iii) motorised vehicle; (iv) electronic device; (v) household appliance; (vi) electrical cooking appliance.

[12] As for the SES, these regressors are assumed to be endogenous given problems of selection and inverse causality. First, the wealth dimension is considered to be endogenous for the same reason as the SES. Second, screen time may modify consumption patterns, whereas obesity could reduce out-of-home movement and encourage inactive lifestyles. Besides, non-observable factors (such as genetic, individual and environmental characteristics) might simultaneously explain the preference for these activities and the gain in weight.

[13] Given that alcohol consumption data are incomplete and of little relevance to the survey, we do not take this information into account.

[14] The Sargan-Hansen test of over-identification accepts the null assumption that the instrument set built by the Hausman-Taylor estimator is exogenous. Therefore, instruments seem to correct endogeneity problems.

higher for Mexican women than Mexican men (OECD, 2013), only a small difference is detected between coefficients of socioeconomic classes from the two gender subsamples.

- ***Influence of other indirect factors (OIF) on anthropometric indicators (AI)***

To begin with, we observe that some covariates are non-significant in any subsample. This is the case for household assets, ethnicity of family head, public transfers, infrastructure development and number of primary schools. However, many other explanatory variables significantly determine bodyweight indicators. As already explained by Palma-Coca et al. (2011), living in the south of Mexico is a factor protecting against weight gain.[15] On the other hand and contrary to preconceived ideas, living in urban communities with more than 100,000 inhabitants might significantly reduce adiposity risks, especially for women. First, even if the urbanization process can contribute to inactive lifestyles, bigger Mexican cities may provide more benefits than extra-urban areas. Booth et al. (2005) detail the argument with some explanations: (i) smaller agglomerations have fewer sports facilities, pedestrian facilities and public transportation which could encourage alternatives to motorized vehicles, such as walking or cycling;[16] (ii) densely populated communities supply a greater variety of food given the existence of various supermarkets; (iii) socioeconomic opportunities are more restricted in extra-urban areas (few schools, few highly-qualified jobs, lower incomes); (iv) urban areas with lower populations have fewer health centers and are less well provided with communication networks which can prevent nutritional and health risks. Second, the place and the social role of Mexican women are closely associated with the living area. Given that low-population communities often attribute a domestic role to women, their lifestyle might lead to obesity (little movement outside the house, low levels of personal fulfillment and self-esteem and few socioeconomic opportunities). In bigger cities, quite the opposite is true: women can benefit from more rights (empowerment) and socioeconomic opportunities (even if gender inequalities persist). In addition, they may remain more easily in contact with communication channels which simultaneously disseminate the virtues of healthy lifestyles and the western stereotype of the "perfect" woman (Chant, 2003).

As observed in previous studies, for both sexes, the non-linear influence of age on anthropometric status (inverted U relationship) relates to the metabolic changes caused by the aging process of the body (Elia, 2001; Palma-Coca et al., 2011). Another piece of evidence

[15] Insofar as north Mexico is more urbanised and more influenced by North American culture, the prevalence of obesity is greater in this region.

[16] Nevertheless, according to our findings, the infrastructure development variable is not significant. Therefore, this explanation is unlikely to have a significant effect.

that stands out from the literature is the influence of marital status on weight gain (Bonnefond and Clément, 2014). In our case, Mexicans in couples are more likely to put on fat than single individuals, independent of gender. Also, the loneliness caused by psychological troubles (death, divorce, job loss, etc.) could be a factor leading to becoming overweight (Noppa et Hällström, 1981). This may explain why separated, divorced or widowed Mexican men are more threatened by central adiposity (no effect is observed for women).

Finally, as expected, the screen time outside employment degrades the anthropometric health of individuals in general. However, this activity seems more damaging to men than to women. In the Chinese context, Bonnefond and Clément (2014) argue that men may make more use of this pastime in order to relax and enjoy themselves. In contrast, women might feel more concerned by educational programs (or websites) informing them about nutritional and other types of behavior that can lead to better health. In the case of smoking, the results from the literature appear to be ambiguous. While for certain authors smoking is associated with weight loss, for others, smoking accentuates fat accumulation. Chiolero et al. (2008) clarify the question. In the short term, nicotine increases the burning off of calories and might reduce appetite and weight. However, long-term smokers are generally fatter than others for two main reasons: (i) active smoking is often associated with inactive lifestyles and other high-risk behaviors (such as a poor diet, alcohol consumption); (ii) smoking increases the resistance to insulin and is associated with central adiposity. Therefore, it comes as no surprise that smoking is a significant determinant of weight gain in urban Mexico, especially for men. We can assume once again that women's preoccupation with nutrition and health (even if they smoke) protects them against the adoption of complementary risks (such as junk food, alcohol, inactive lifestyles) in order to limit the effects of tobacco on their weight (Fontaine et al., 1998).

Table 2: Hausman-Taylor estimates

	ALL ADULTS		MEN		WOMEN	
	BMI	WHtR	BMI	WHtR	BMI	WHtR
Time-varying exogenous variables						
Age	0.4689***	0.0050***	0.4782***	0.0056***	0.5102***	0.0050***
	(12.14)	(6.68)	(12.67)	(6.37)	(15.66)	(7.44)
Age squared	-0.0054***	-0.0001***	-0.0058***	-0.0001***	-0.0049***	-0.0001***
	(-13.76)	(-7.42)	(-14.69)	(-9.03)	(-12.94)	(-5.23)
In pairs (base=single)	0.5493***	0.0107***	0.4984***	0.0124***	0.6109***	0.0125***
	(3.08)	(3.27)	(2.71)	(3.23)	(3.54)	(3.86)
Separated (base=single)	0.0905	0.0056	0.6033**	0.0125**	-0.0082	0.0044
	(0.43)	(1.47)	(2.15)	(2.09)	(-0.05)	(1.31)
Smoking	0.1541	0.0034*	0.1012	0.0034*	0.2643*	0.0022
	(1.37)	(1.66)	(1.09)	(1.74)	(1.87)	(0.83)
Higher urban agglomeration	-0,4911***	-0.0104***	-0.1313	-0.0062*	-0.7507***	-0.0138***
	(-3.22)	(-3.69)	(-0.83)	(-1.90)	(-4.98)	(-4.91)
Region (south)	-1,1303*	-0.0400***	-0.7233	-0.0502***	-0.5107	-0.0217*
	(-1.66)	(-2.67)	(-1.03)	(-2.60)	(-1.06)	(-1.71)
First survey wave (base=third wave)	-0.8755***	-0.0512***	-1.0262***	-0.0466***	-0.3294**	-0.0497***
	(-4.23)	(-12.47)	(-5.56)	(-9.74)	(-2.37)	(-14.81)
Second survey wave (base=third wave)	-0.8757***	-0.0212***	-0.8279***	-0.0242***	-0.6559***	-0.0163***
	(-6.82)	(-8.43)	(-7.02)	(-8.21)	(-7.07)	(-7.75)
Time-varying endogenous variables						
Members by room	0.0413	0.0008	0.0674**	0.0006	0.0227	0.0008
	(1.34)	(1.35)	(2.00)	(0.90)	(0.79)	(1.53)
Household assets	-0.0439	0.0004	-0.0325	0.0010	-0.0486	0.0000
	(-1.09)	(0.54)	(-0.77)	(1.20)	(-1.26)	(-0.07)
Screen time	0.0077**	0.0001*	0.0128***	0.0002***	0.004	0.0001
	(2.47)	(1.94)	(3.96)	(2.99)	(0.11)	(1.03)

Time-invariant exogenous variables						
Gender	-0.8612**	-0.0203*	_	_	_	_
	(-2.07)	(-1.70)				
Ethnicity of the household head	0.1472	0.0184	-0.4407	0.0344	0.7305	0.0298
	(0.13)	(0.58)	(-0.26)	(0.58)	(0.74)	(1.03)
Public transfers	-1.6064	-0.0382	-1.1287	-0.0198	0.1640	-0.0012
	(-1.32)	(-1.19)	(-0.85)	(-0.41)	(0.20)	(-0.05)
Infrastructure development	0.2394	0.0011	-0.3292	-0.0437	0.0589	0.0012
	(0.46)	(0.08)	(-0.34)	(-1.28)	(0.17)	(0.12)
Primary school's number	0.0004	0.0000	0.0008	0.0001	0.0001	-0.0000
	(0.33)	(0.37)	(0.43)	(1.25)	(0.11)	(-0.26)
Time-invariant endogenous variables						
Base=Group A (Poor)						
Group B (Lower-middle class)	50.8564**	1.4611***	25.8015	1.1453**	13.5127	0.5709*
	(2.07)	(2.88)	(1.51)	(2.28)	(1.18)	(1.91)
Group C (Upper-middle class)	17.0248**	0.4830***	9.5672	0.4219**	5.9145	0.2000*
	(2.02)	(2.63)	(1.48)	(2.02)	(1.31)	(1.65)
Group D (Rich)	33.0620**	0.9797***	22.0165	1.2855**	13.1696	0.4523*
	(2.09)	(2.83)	(1.41)	(2.49)	(1.38)	(1.81)
Constant	-13.3186	-0.4282	3.1309	-0.1166	7.4847	0.0866
	(-0.89)	(-1.33)	(0.30)	(-0.35)	(0.98)	(0.42)
sigma_u	14.7619	0.4369	16.8733	0.5859	13.1009	0.3942
sigma_e	2.3196	0.0429	2.1591	0.0407	2.4173	0.0438
rho	0.9759	0.9904	0.9839	0.9952	0.9671	0.9878
Number of obs	15318	15193	6698	6667	8620	8526
Wald Chi2	1023.39	3052.46	918.87	1509.48	1177.13	4056.38
(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Sargan-Hansen test	1.513	4.498	5.357	4.979	4.486	6.946
(p-value)	(0.9586)	(0.6096)	(0.4990)	(0.5465)	(0.6112)	(0.3259)
Chow test	7.185	6.936	_	_	_	_
(p-value)	(0.0000)	(0.0000)				

Note: In brackets we find Wald test statistics, excepted for the Sargan-Hansen test, in which the statistic is asymptotically distributed as a Chi-square variable, and the Chow test, which follows a Fisher distribution. Significant levels are as following: ***p<0,01, **p<0,05, *p<0,1.

Source: MxFLS (2002-2012)

- ***The influence of socioeconomic class (SEC) on anthropometric indicators (AI)***

Coefficients of the impact of SES classes on central adiposity (based on WHtR) are shown in Figure 2. As assumed, individuals from the poorest socioeconomic class (group A) are the thinnest, whereas individuals from the lower-middle class (group B) are the fattest, whether measured by the BMI or by the WHtR (marginal effects equal to 50.86 for BMI and 1.46 for WHtR). Our results thus confirm assumptions from previous studies (Fernald, 2007). It seems that a socioeconomic class on the margin of poverty has growing access to Western patterns of consumption. Insofar as the occupation and education dimensions of group B are relatively better, its members can improve their levels of income and consumption. Nevertheless, if we think in absolute terms, both groups (A and B) have similar living conditions and, in either case, household heads are poorly educated (not having gone beyond primary school). Therefore, for both classes, income and occupation dimensions play essential roles in determining differences in anthropometric status. If increased income is not followed by an increase in knowledge (especially in terms of health and nutrition), it may result in inappropriate behavior leading to significant health problems, particularly with sedentary jobs and routines (Kain et al., 2003).

In contrast to standard assumptions based on middle-income countries, the causal relationship between socioeconomic and anthropometric status does not seem to follow an inverted U shape in urban Mexico. In fact, anthropometric indicators are higher among individuals from the rich class (group D) than individuals from the upper-middle class (group C), with coefficients equal to 33.06 and 17.02 respectively for the BMI, and, 0.98 and 0.48 for the WHtR. Although these results may appear counter-intuitive, researchers from the OECD (2014) observe a current surge in the BMI of the most educated individuals in countries with the highest prevalence of obesity (USA and Mexico), particularly among men. It thus appears that elite strata are more and more threatened by weight gain when obesity prevalence reaches endemic levels. From our perspective, two main factors can explain the nutritional risks associated with group D: (i) a sedentary job; (ii) a career-orientated lifestyle. First, the most remunerative occupations (senior management, professional and intellectual jobs) are generally known for their sedentary characteristics (a long time spent in the office and at a screen). Second, as we have already seen, group D could be associated with better incomes and highly skilled positions. These career-orientated lifestyles can be linked to indirect factors of weight gain such as material well-being, decrease in free time and chronic strain. Material prosperity might lead to sedentary pastimes, whereas lack of free time and chronic stress contribute to a rise in central adiposity through their effects on the metabolism and routines

(inactive routines, frequent consumption of fast-foods, ready-made meals, tobacco, alcohol, etc.) (Brunner et al., 2007). In addition, such authors as Robinson and Christiansen (2014) showed the changing perception of what is considered a socially acceptable weight in obesogenic environments. While overweight status was generally associated with healthier weight by participants from the USA, they observed that most interviewed people thought obese persons did not need to lose weight. The progressive social acceptation of adiposity could lead to increase overweight and obesity prevalence, also in the Mexican upper class. Nonetheless, although belonging to the rich class is associated with weight gain, the prevalence of obesity among this group is the lowest, despite some differences between the genders (Table A.5 in the Appendix).[17] As revealed by Bonnefond and Clément (2014) in the Chinese context, even though a large body seems to characterize individuals from the upper classes, these individuals (particularly women) are also more frequently conscious than others about the health and social complications associated with extreme bodyweight. However, more research is needed in order to determine whether richer and better educated Mexicans really adopt healthier behaviors as suggested in previous studies (*see* Sepúlveda Amor, 2003). For example, qualitative models could identify whether the upper class is less threatened by overweight or obesity.

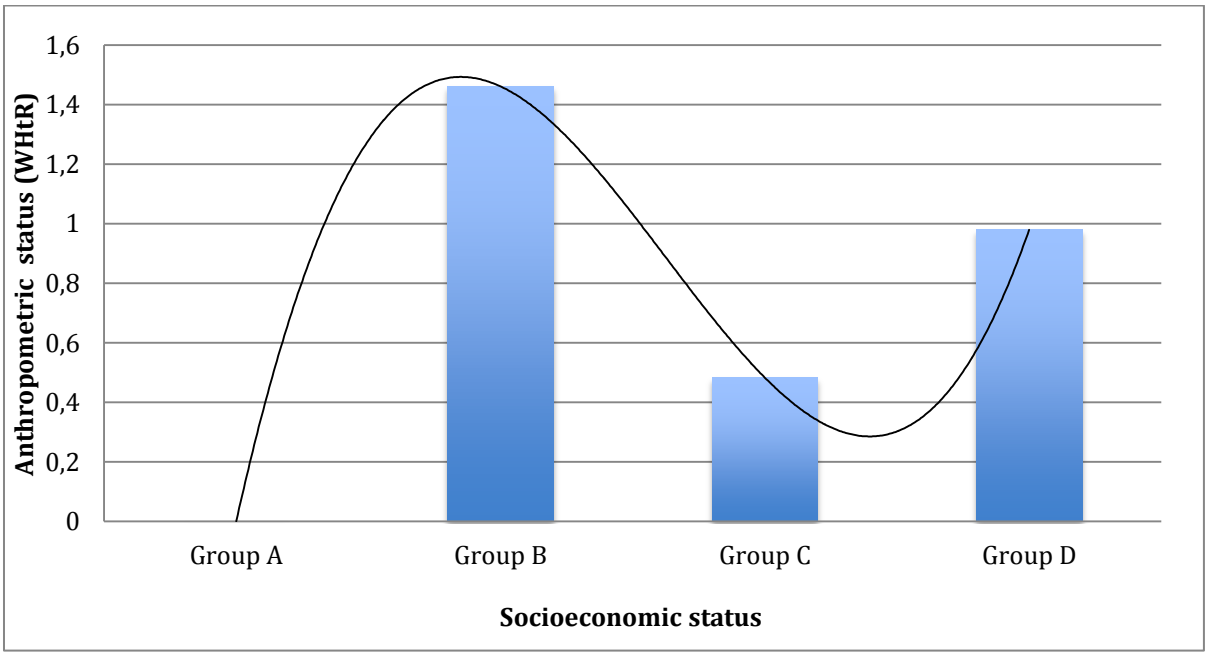
Finally, the analysis with regard to gender calls for three comments. First, it shows limits to the use of BMI as an international standard in order to capture central adiposity. Although we observe a significant effect of SES on BMI for the whole sample, no significant effect is detected for either gender subsamples. Second, insofar as SES groups have a significant impact on the WHtR both for men (at the 5% level) and for women (at the 10% level), complementing the WHtR with the BMI would appear to be relevant. Both follow an inverted U-shaped relationship between groups A and C, and a positive relationship between groups C and D. Third, although in general women are more likely to be overweight than men in Mexico, the impact of SES on the WHtR seems more pronounced for men than for women (significance levels are more acceptable in the male subsample). These results go against the literature (McLaren, 2007; Sobal and Stunkard, 1989). However, Monteiro et al. (2004b) note that the expansion of obesity among women with lower SES could occur at an earlier stage of economic development than among men (when the GDP per capita was around 2,500 USD). Nevertheless, Mexico reached this stage over two decades ago (from 1990). Therefore, we can assume that during the last decade, the SES of men has become more sensitive to weight

[17] According to the WHtR, while the lowest prevalence of obesity is observed among women from group D, the obesity rate among men from group D is higher than those from group A, but lower than those from group B.

gain than for women. This may explain why Barquera et al. (2009) find that lower incomes were positively associated with central adiposity in 2006, especially for Mexican men.

Several specific factors may play a preponderant role in women's behavior and could reduce the influence of households' SES on their bodyweight in Mexico. First, as described in the results for other indirect factors (*OIF*), women could be more concerned about health and weight than men, independently from the household's SES. Second, in general women are more exposed to food-related conditions, such as anorexia or bulimia, than men (Palma-Coca et al., 2011). Third, the first two factors can be highlighted insofar as there is a deeply ingrained misogyny in Mexican society, in addition to the fact that women have very little decision-making power in the household. As a consequence, a household's SES might be slightly different to that of its female members SES (Chant, 2003).

Figure 2: Coefficients of the impact of SES on WHtR into the whole sample



Source: MxFLS (2002-2012).

6. Conclusion

Using panel data from the *Mexican Family Life Survey* (MxFLS), the main purpose of this study was to estimate the causal effect of households' socioeconomic status (SES) on nutritional outcomes among adults in urban Mexico. The analysis has tried to address some conceptual and methodological limits encountered in the existing literature by: (i) breaking with the linear vision of the relationship between socioeconomic and anthropometric status (separating SES into classes); (ii) considering SES as multidimensional; (iii) using alternative anthropometric indicators to the international standard; (iv) analyzing the nutrition transition as a sequential process. With all this in mind, the work was divided into two main steps. First,

using a mixed clustering procedure based on 2002 cross-section data, we distinguished four socioeconomic groups of households with regard to income, educational and occupational dimensions: (i) a poor class; (ii) a lower-middle class; (iii) an upper-middle class; (iv) a rich class. Second, using an adapted econometric model (Hausman-Taylor estimator), we estimated the impact of belonging to these socioeconomic classes on the anthropometric status of individuals, using the body-mass index (BMI) and the waist-to-height ratio (WHtR).

Our results shed light on some interesting conclusions. First, belonging to the lower-middle class may significantly increase the risk of central adiposity. So we can accept the assumption that a new middle class rising out of poverty (called "the new poor" or "strugglers" by Birdsall et al., 2014, p.132) is the most exposed to weight gain. Second, individuals from the upper class are significantly fatter than individuals from the upper-middle class. It seems that sedentary, career-orientated and stressful lifestyles might accentuate weight gain without necessarily leading to critical bodyweight. Consequently, we have to reject the assumption of an inverted U-shaped relationship between socioeconomic and anthropometric status, as commonly suggested by previous studies. Third, over the last decade in Mexico (2002-2012), the influence of SES on the WHtR appears to be more pronounced for men than women.

Our results enrich the literature in several ways. First, our findings highlight the limitations of the BMI as an indicator of adiposity in social sciences. Not only does the BMI under-estimate the prevalence of overweight and obesity in Mexico, but also the use of alternative and better-adapted indicators (such as the WHtR) gives relevant results for both sexes in regards to the relationships studied in this paper. Second, the multidimensional identification of SES shows that income, education and occupation components have decisive and interdependent effects on anthropometric health indicators. The income dimension has long been perceived by the economic literature as the main determinant of bodyweight. However, we can now suggest that, above a certain threshold, it may not be the income per se which deteriorates anthropometric status, but rather the use that individuals make of it (the income thus takes on an instrumental role). Therefore, education should be a key factor because it has a potential impact on healthcare patterns. Nevertheless, lifestyles are also determined by occupation. As we have seen, some jobs (positions with high levels of responsibility, precarious and informal activities) and career-orientated lifestyles can be related to stress, anxiety and little free time, often resulting in an unhealthy way of life.

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APPENDIX

Table A.1: Descriptive statistics

	Mean	Std. Dev.	Min	Max	Obs.
Time-varying exogenous variables (control)					
Age	34.63	12.28	16	59	N = 22328
Age squared	1349.75	890.19	256	3481	N = 22328
In pairs	0.60	0.49	0	1	N = 22324
Separated	0.07	0.25	0	1	N = 22324
Single	0.34	0.47	0	1	N = 22324
Smoking	0.18	0.38	0	1	N = 18347
Higher urban agglomeration	0.62	0.49	0	1	N = 22328
Region (base=south-east)	0.21	0.41	0	1	N = 22328
First wave (2002)	0.31	0.46	0	1	N = 22328
Second wave (2005-2006)	0.33	0.47	0	1	N = 22328
Third wave (2009-2012)	0.36	0.48	0	1	N = 22328
Time-varying endogenous variables (control)					
Members by room	2.62	1.50	0.06	17	N = 22262
Household assets	4.19	0.97	0	6	N = 21886
Screen time (hours by weeks)	13.55	11.88	0	150	N = 18416
Time-invariant exogenous variables (control)					
Gender	0.48	0.50	0	1	N = 22328
Ethnicity of household heads	0.04	0.19	0	1	N = 21890
Public transfers	0.07	0.26	0	1	N = 22165
Development level of infrastructures	5.49	0.81	3	6	N = 22304
Primary school's number	178.96	197.50	0	890	N = 22067
Time-invariant endogenous variables					
Group A (poor)	0.11	0.31	0	1	N = 22328
Group B (lower middle class)	0.41	0.49	0	1	N = 22328
Group C (upper middle class)	0.32	0.47	0	1	N = 22328
Group D (rich)	0.16	0.37	0	1	N = 22328
Outcome variables					
Body Mass Index (BMI)	27.48	5.42	7.57	61.37	N = 16809
Waist-to-Height Ratio (WHtR)	0.56	0.09	0.30	1.02	N = 16667

Source: MxFLS (2002-2012).

Table A.2: Correlation between variables

Variables	BMI	WHR	Age	Age squared	In pairs	Separated	Single	Smoker	Higher urban.	Region	First wave	Second wave	Third wave	Members by room
BMI	1													
WHtR	0.83	1												
Age	0.29	0.46	1											
Age squared	0.22	0.40	0.98	1										
In pairs	0.26	0.28	0.38	0.28	1									
Separated	0.05	0.12	0.30	0.32	-0.40	1								
Single	-0.31	-0.38	-0.59	-0.50	-0.81	-0.21	1							
Smoking	-0.01	-0.01	0.06	0.05	0.07	0.00	-0.08	1						
Higher urban.	-0.01	-0.02	-0.01	-0.01	-0.02	0.03	0.01	0.07	1					
Region	0.01	0.02	0.03	0.03	0.00	0.00	0.01	-0.08	-0.13	1				
First wave	-0.02	-0.17	-0.04	-0.05	0.06	-0.01	-0.05	0.07	0.01	0.00	1			
Second wave	-0.03	0.03	0.02	0.02	-0.01	0.02	0.00	-0.06	0.03	0.00	-0.50	1		
Third wave	0.05	0.14	0.03	0.03	-0.05	-0.01	0.06	-0.01	-0.04	0.00	-0.50	-0.50	1	
Members by room	-0.03	0.01	-0.12	-0.12	0.06	-0.04	-0.04	-0.02	-0.05	0.08	-0.06	-0.03	0.09	1
Household assets	0.01	-0.04	-0.01	-0.02	0.03	-0.08	0.02	0.01	0.01	-0.04	0.08	0.06	-0.14	-0.19
Screen time	-0.04	-0.07	-0.19	-0.17	-0.12	-0.05	0.15	0.04	0.09	-0.06	-0.06	-0.03	0.09	-0.04
Gender	-0.11	-0.14	-0.02	0.00	0.04	-0.15	0.05	0.24	-0.01	0.00	0.00	0.00	0.00	-0.02
Ethnicity	-0.01	0.03	0.04	0.04	0.02	0.00	-0.03	-0.04	-0.11	0.14	-0.01	0.01	0.00	0.06
Public transfers	-0.02	0.01	0.02	0.02	0.00	-0.02	0.01	-0.05	-0.26	0.08	-0.02	0.01	0.01	0.10
Infrastructures	0.01	-0.01	0.01	0.01	-0.04	0.02	0.03	0.02	0.43	-0.11	0.00	0.00	0.00	-0.07
Primary schools	-0.01	-0.03	-0.01	-0.01	-0.02	-0.01	0.03	0.06	0.53	-0.16	-0.01	0.00	0.00	-0.02
Group A	-0.01	0.06	0.19	0.23	-0.09	0.10	0.03	-0.02	-0.05	-0.02	0.02	0.01	-0.03	0.02
Group B	0.03	0.06	0.02	0.02	-0.03	0.03	0.01	-0.02	-0.06	0.03	0.00	0.00	0.00	0.13
Group C	-0.01	-0.05	-0.15	-0.17	0.08	-0.07	-0.04	0.02	0.05	-0.02	-0.01	-0.01	0.02	-0.03
Group D	-0.03	-0.07	-0.02	-0.03	0.02	-0.05	0.01	0.03	0.07	0.01	-0.01	0.00	0.00	-0.17

Variables	Members by room	House-hold assets	Screen time	Gender	Ethnicity	Public transfers	Infra-structures	Primary schools	Group A	Group B	Group C	Group D
Members by room	1											
Household assets	-0.19	1										
Screen time	-0.04	0.04	1									
Gender	-0.02	0.03	-0.02	1								
Ethnicity	0.06	-0.06	-0.07	0.01	1							
Public transfers	0.10	-0.02	-0.08	0.00	0.21	1						
Infrastructures	-0.07	0.06	0.05	-0.01	-0.09	-0.18	1					
Primary schools	-0.02	0.01	0.05	0.01	-0.09	-0.19	0.48	1				
Group A	0.02	-0.10	-0.09	-0.01	0.06	0.09	-0.02	0.01	1			
Group B	0.13	-0.11	-0.04	-0.02	0.02	0.07	-0.10	-0.04	-0.33	1		
Group C	-0.03	0.04	0.05	0.02	-0.03	-0.10	0.03	0.00	-0.26	-0.56	1	
Group D	-0.17	0.20	0.08	0.02	-0.04	-0.06	0.12	0.04	-0.16	-0.35	-0.28	1

Source: MxFLS (2002-2012).

Table A.3: Frequencies from three dimensions of SES

	Observations	Percentage (%)
Household income (decile)	*3911*	*100*
Decile 1	391	10
Decile 2	391	10
Decile 3	388	9.9
Decile 4	393	10
Decile 5	373	9.5
Decile 6	411	10.5
Decile 7	398	10.2
Decile 8	385	9.8
Decile 9	390	10
Decile 10	391	10
Household head's education level	*3911*	*100*
Without instruction	330	8.5
Elementary	1508	38.6
Secondary	976	25
High school and similar degrees	532	13.6
Higher degrees	556	14.3
Household head's occupation	*3911*	*100*
Inactive	189	4.8
Unpaid worker	262	6.7
Informal worker	1009	25.8
Formal employee	1351	34.5
Self-employed worker	870	22.2
Employer	230	5.9

Source: MxFLS (2002).

Table A.4: Means and frequencies of illustrative variables

Illustrative variables	Group A N=500 (12.8%)	Group B N=1454 (37.2%)	Group C N=1298 (33.2%)	Group D N=659 (16.8%)	All N=3911 (100%)
Household head's characteristics					
Male	*66.6%*	*78.1%*	**88.1%**	**87.4%**	81.5%
Age (average)	**60**	46	*37*	*43*	44
Married	*51.0%*	*61.0%*	**72.7%**	**78.3%**	66.5%
Ex-rural	**22.0%**	**16.8%**	*5.6%*	*4.4%*	11.7%
Domestic worker	**14.2%**	**8.0%**	*0.3%*	*2.0%*	5.2%
Retired	**18.0%**	*0.0%*	*0.0%*	*1.5%*	2.6%
Housing characteristics					
One property	**87.2%**	71.7%	*65.7%*	**77.2%**	72.0%
Second property	17.6%	*16.9%*	*18.1%*	**30.3%**	19.7%
Modern roofing	*76.2%*	*75.5%*	**86.1%**	**94.1%**	82.2%
Modern sewage	76.2%	*74.1%*	79.6%	**89.1%**	78.7%
Modern toilets	*85.0%*	*85.3%*	**91.8%**	**98.3%**	89.6%
Telephone line	*43.2%*	*37.6%*	47.1%	**78.3%**	48.4%
Durable and equipment goods of the household					
Motorised vehicle	*24.6%*	*30.1%*	**43.8%**	**75.9%**	41.7%

Television	*91.2%*	*95.3%*	**98.2%**	**97.6%**	96.1%
Housing appliance	*89.4%*	*93.3%*	**97.4%**	**97.9%**	94.9%
Urbanisation of the community					
Between 2,500 and 15,000 inhabitants	**24.6%**	**23.6%**	*13.6%*	*7.8%*	17.7%
Between 15,000 and 100,000 inhabitants	15.6%	*14.5%*	16.7%	17.5%	15.9%
More than 100,000 inhabitants	*59.8%*	*61.9%*	**69.6%**	**74.8%**	66.4%
Household income and saving					
Income (average)	*39354*	*40197*	*50941*	**145320**	61368
Saving	*17.6%*	*13.9%*	**26.7%**	**42.5%**	22.8%
Income composition					
Wage	*81.3%*	89.8%	**92.5%**	**90.4%**	89.7%
Private transfers	**7.4%**	5.1%	4.5%	*3.4%*	4.9%
Asset income	0.5%	0.4%	*0.3%*	**1.5%**	0.6%
Public transfers	**10.7%**	4.6%	*3.0%*	5.0%	4.9%
Insecurity and social vulnerability of the household head					
Formal contract (written)	*4.6%*	*13.1%*	**58.6%**	**57.1%**	34.5%
Social insurance	*49.4%*	*43.3%*	**70.3%**	**75.1%**	58.4%
Social transfers from the government	**11.4%**	**8.5%**	*3.3%*	*2.4%*	6.1%
Consumption patterns of the household head					
Drinking potable water	*52.6%*	*56.2%*	**67.7%**	**78.9%**	63.4%
Smoking (number of months)	**78.95**	55.99	*47.25*	56.87	56.23
Sport time (hours/week)	*0.579*	*0.665*	**1.078**	**1.294**	0.895
Screen time (hours/week)	*9.291*	*10.379*	**12.169**	**12.239**	11.141
Active works outside job (hours/week)	**6.573**	**5.150**	*3.979*	4.378	4.818

Note: Bold values express significant and positive differences of each group compared to the total average, while italic values show significant and negative differences of each group compared to the total average. Others values are not significant differences compared to the total average.

Source: MxFLS (2002).

Table A.5: Obesity and overweight prevalence according to socioeconomic classes among urban adults from Mexico

		Group A	Group B	Group C	Group D
Obese (WHtR)	*Overall*	38.9%	41.7%	36.6%	32.6%
	Men	*27.9%*	*33.9%*	*32.7%*	*32.8%*
	Women	*46.5%*	*47.8%*	*40.5%*	*32.5%*
Overweight (WHtR)	*Overall*	70.5%	74.0%	71.8%	70.6%
	Men	*65.2%*	*69.5%*	*69.4%*	*73.2%*
	Women	*74.3%*	*77.6%*	*73.9%*	*68.3%*
Obese (BMI)	*Overall*	26.1%	29.9%	27.8%	24.2%
	Men	*15.3%*	*22.7%*	*24.1%*	*23.8%*
	Women	*33.6%*	*35.5%*	*31.0%*	*24.6%*
Overweight (BMI)	*Overall*	62.5%	66.4%	66.5%	66.5%
	Men	*60.0%*	*62.3%*	*67.0%*	*70.0%*
	Women	*65.0%*	*69.6%*	*66.0%*	*63.5%*

Source: MxFLS (2002-2012).