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Abstract³

This paper explores the possibilities of using structural equation modelling to measure capabilities of Italian children. In particular the paper focuses on two capabilities: “Senses, Imagination and Thought” and “Leisure and Play Activities”.

The indicators used to measure the capability of ‘Senses, imagination and thought’ for 6-13 years old children are attitude towards education, attendance to arts classes and other type of extra curriculum classes like computing and languages. The variables used as indicators of the capability of “Leisure and play activities” include how often children play in playground, various types of games, attendance to sports classes.

We use both descriptive statistics, an ordered probit model, and a structural equation model in order to investigate the relation among the above mentioned indicators, the latent construct for capabilities and a set of covariates. Moreover we use a new data set in order to include family income among the covariates. The data result from the matching (through a propensity score method) of two data sets: Bank of Italy Survey on Income and Wealth for year 2000 and Istat Families, social subjects and childhood condition for year 1998.

JEL: I2, C1, J1

Keywords: Education, Capabilities, Child well-being, Structural Equation Modelling

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1. Introducing children capabilities.

This paper explores the possibilities of using structural equation modelling to measure capabilities of Italian children. We focus on two capabilities relevant for evaluating children's well being in Italy:

- a. *Senses Imagination and Thought.*
- b. *Leisure activities, play.*

These capabilities were chosen both because they are particularly relevant in children development, they are very low in Italy compared to OECD countries (UNICEF 2007), and they show high variance across regions.

In the capability literature, there has been an increasing concern about how to choose and define capabilities (Robeyns 2003, Nussbaum 1999) and specifically children capabilities (see the other contributions to this book, Saito 2003 and Phipps 2002). The paper of Phipps (2002) compares well being of children in USA, Canada and Norway, measuring 10 specific functionings (low birth-weighting, asthma, accidents, activity limitation, trouble concentrating, disobedience at school, bullying, anxiety, lying, hyperactivity). She adopts a descriptive approach and finds out that Norwegian children have better outcomes than US and Canada children. The paper of Saito (2003) explores the possible relation between capabilities and education; she reports Sen's interview on the application of the capability approach to children.

“ If a child does not want to be inoculated, and you nevertheless think it is a good idea for him/her to be inoculated, then the argument may be connected with the freedom that this person will have in the future by having the measles shot now. The child when it grows up must have more freedom. So when you are considering a

child, you have to consider not only the child's freedom now, but also the child's freedom in the future”⁴

Nussbaum (2003) argues that the capability approach should endorse a theory of social justice where the subjects are not anymore only “fully cooperating members of society over a complete life”⁵ .

“ So I believe we need to delve deeper, redesigning the political conception of the person, bringing the rational and the animal into a more intimate relation with one another, and acknowledging that there are many types of dignity in the world, including the dignity of mentally disabled children and adults, the dignity of the senile demented elderly, and the dignity of babies at the breast. We thus need to adopt a political conception of the person that is more an Aristotelian than Kantian, one that sees the person from the start as both capable and needy – “ in need of a rich plurality of life-activities “ to use a Marx's phrase, whose availability will be the measure of well-being.” (Nussbaum 2003 pp. 29-30.)

Following Nussbaum, in order to conceptualise children capabilities, we consider children as subjects and we use her definition for the capability of *Senses Imagination and Thought*:

“Being able to use the senses, to imagine, think, and reason and do these things in a “truly human” way informed and cultivated by an adequate education, including by no means limited to, literacy and basic material skills.” (Nussbaum, 1999 p.81).

This is a basic capability for the development of children. Quality of education both in primary schools and kindergartens plays a crucial role in children cognitive

⁴ Sen's response in the interview with Saito in March 2001 reported in Saito (2003) pag 25.

⁵ Rawls 1980, pag 546, citation taken from Nussbaum 2003.

development (Clarke et al 2005). Attending a kindergarten has a positive effect on children cognitive ability, and this effect is higher in poorer households (Waldfogel 2002), Magnuson et al. 2004). Positive effects of pre-compulsory education on children's cognitive development have been found to be significant and diminishing up to the age of 16 (Goodman and Sianesi 2005).⁶

The other capability we analyse in this paper includes leisure and playing activities. The role of this capability in children's well being is essential. Nevertheless, its functionings are not easily observable. Psychologists stress that it is not only important to assess the quantity but also the quality of playing activities. This capability is strongly correlated to other children's capabilities like social interaction and education. Not playing alone requires interaction with other children, parents or with other individuals. This capability differs across regions which are characterised by different types of schools and leisure activities. One element to be considered is the decrease of time devoted to un-structured (not organised) leisure time.

In this paper we try to measure the above mentioned capabilities utilising Italian data on 6-13 years old children. In Section 2 we analyse the Italian children education and labour conditions. In Section 3 the relation between income and children outcome is explored. In Section 4, we outline the econometric model. We apply a Multiple Indicator Multiple Causes model (MIMIC) because MIMIC models allow the use of multiple indicators of the analysed capabilities and at the same time it allows to analyse the effects of some covariates on children capabilities. The indicators used to measure the capability of 'Senses, imagination and thought' for 6-13 years old children are attitude towards education, attendance to cultural and artistic activities.

⁶ They used National Child Development Studies on children born in 1958 controlling for individual, household and neighbourhood variables.

The variables used as indicators of the capability of “Leisure activities and play” include how often children play in playground and various types of children games, attendance to sports classes.

Section 5 explains the data set which are the result of the matching of two data set: the 2000 Bank of Italy Survey on Income and Wealth and the 1998 ISTAT FSS (Famiglie, Soggetti Sociali e Condizione dell’Infanzia⁷). Finally results are presented in Section 6.

2. Italian children education and labour.

According to a compounded index of some measures of school achievement at age 15, the percentage of aged 15-19 children in education, the percentage of aged 15-19 not in education, training or employment, Italy ranks at the 23th position out of 24 OECD countries (Unicef 2007). The other dimensions analysed by Unicef (2007) concern material well being (14th position), health and safety (5th position), family and peer relationships (first position), behaviour and risks (10th position) and subjective well being (10th). The Unicef educational well-being index utilises PISA (Programme of International Student Assessment) 2000 survey. Italy (together with Spain, Portugal and Greece) is at the bottom of the list of OECD countries in terms of reading, mathematics and scientific literacy. The percentage of Italian aged 15-19 years old children in education (another measure included in Unicef educational index) is also very low (18th position).

Drop out rates in primary school, in school year 2002/2003 are on average 0.08% with a little variation across areas, drop outs in secondary school in year 2002/2003 are more heterogeneous across regions: 0.10% in the North to 0.59% in the South and 0.55% in the Islands. High school drop out rate in school year 2001/2002 is equal to

⁷ Households, Social Subjects, and Children conditions.

3.77% in the Islands, 2% in the South of Italy and around 1% in the Centre-North (Ciccotti et al 2007).

Attending a kindergarten has a strong influence on school performances. On the whole, kindergartens' attendance increased from 5.8% in 1992 to 9.9% in 2005 (Ciccotti and Sabbadini, 2007). However, though increasing, the attendance rate of children aged less than 3 in Italy is still far away from the 33% target fixed by the European Union (Ciccotti, Moretti and Ricciotti, 2007). This figure shows a high variance across regions: 2% in Calabria (a Southern region) and 24% in Emilia Romagna (a Central region with a good regional social welfare), (Ciccotti et al 2007). These figures are correlated with a high variance of the availability of nursery schools across regions (Istituto degli Innocenti 2002), the lowest figures are to be found in the South.

On the other hand, 104.4 per cent of the 3-5 years old children attended kindergartens in school year 2003/2004, with a low variance across regions⁸ (Ciccotti et al. 2007). However, the number of 3-5 years old children who don't have a school lunch in kindergartens is higher in the Southern regions and in the Islands (Ciccotti and Sabbadini, 2007, p.15).

As far as primary school is concerned, we note that there is a high variance across regions in the availability of 'full-time' schools whose time-table covers also the afternoon (2% in Palermo and 90% in Milan) and can be more compatible with parents' working time, given the relatively low availability of part-time work in Italy with respect to other countries.⁹ Moreover not all the schools provide lunch: Ciccotti and Sabbadini (2007) using data of ISTAT multipurpose survey for the year 2005, show that 71.7% in North West have school lunch, 62.1% in North East, 57.3% in the Centre, 19.8% in the South and 11.8% in the Islands.

⁸ The above 100 percentage figure is due to the enrolment in schools of foreigners who have not yet been recorded by the Civil Register (Ciccotti et al., 2007 p.33).

⁹ First Report on School Quality by Tuttoscuola (www.tuttoscuola.com).

An important issue in assessing the capability to have leisure time and to play is to what extent the child is free from paid or unpaid work. There has been an increased concern for the amount of work performed by Italian children. According to ISTAT 2000 survey, 14.7% of young people from 15 to 18 in Italy had a work experience before they were 15 years old; the percentage is higher for male (18.8%) than for females (10.4%) and in the North-East (20.1%) than in the Centre of Italy (9.9%) and relevant also in the South (14.7%) and in the Islands (13.2%). The higher the secondary school grade is, the lower the percentage of those who had work experience before the age of 15 (Moretti 2004). By using data on past work experience one can estimate that 3% of children aged from 7 to 14 did work in Italy in 2000 . The incidence of working children is 0.5% when they were aged from 7 to 10 and 11.6% for those aged 14.¹⁰

3. Some evidence on the relation between income and children outcomes.

According to the literature, family income has a positive effect on children's cognitive and social development in many ways. Income determines investments in children's human capital (Blau, 1999; Taylor et al. 2004); income is correlated with parental education and better neighbourhood; higher income families have a lower probability to fall in economic hardship and to experience its stressful consequences (Elder et al. 1985, Taylor et al. 2004).

Nevertheless using sibling data from the Panel Study of Income Dynamics on 1,364 households following children between birth and at least age 20 and fixed-effects estimator to control for omitted variables that might be correlated with family income and child outcomes, Levy and Duncan (2000) show that the effect of family income on children's completed years of schooling is very low; moreover only family

¹⁰ Moretti (2004, 71-72)

income at early childhood (0 to 4 years) positively and significantly affects children's schooling.

By using NLSY data (the matched mother-child sample) Blau (1999) finds that the impact of family income on 0-3 years old children's motor and social outcomes and cognitive and language outcomes for 3-7 years old children is higher for permanent rather than current income. In addition, the effect of income is not non linear (this is not consistent with the hypothesis that income effects are higher at lower income levels).

Taylor et al. (2004) focus on outcomes on 15-36 years old children when, according to existing literature (Duncan and Brooks-Gunn 1997) income effects should be larger. They use longitudinal data from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care (SECC). They find that the income effect is similar to the effect of other variables that the literature finds related to children outcomes (like maternal verbal intelligence) by using repeated measures of child's outcomes and assessing their relative weight at different points of income distribution. They also show that the effect of income on children outcomes is not arising only because of the effect that income has on the home environment or on maternal depressive symptoms. The inclusion of other control variables decreases the size of income effect and using random effects estimates, the size of income effect is smaller than by using OLS and permanent income effects are higher than current income's effects. Nonlinearities in the income effects are found to occur at different points in the income distribution according to different outcomes. Also the relative size of the family income coefficient (compared to the coefficients of other relevant factors) are greater for poorer households than for non poor (for instance family income coefficient in poor households is found to be higher than the effect of maternal verbal

intelligence in poor households while the opposite is true in non poor households)¹¹.

Chevalier, Harmon, O'Sullivan and Walker (2005) by using Labour Force Survey data and Instrumental Variable estimate a significant effect of permanent income in reducing drop out rates at age 16.

Policy implications call for alleviating financial constraints that prevent children in disadvantaged environments to improve their education (Plug and Vijverberg 2001), and for the importance of investing on children in disadvantaged environments especially in their early age (Heckman and Masterov 2007).

Section 4 MIMIC and evaluation of Children Well being

Any attempt to operationalise the capability approach needs an adequate framework for the measurement of the abstract unobservable multidimensional concept. One such attempt is the latent variable approach including principal components, factor analysis and Structural Equation Models (SEM). Multiple Indicators Multiple Causes (MIMIC) models are the simplest form of SEM. The first two models provide estimates of the latent variables but are silent on the factors influencing these variables (capabilities in our context). MIMIC models represent a step further in this direction as they include exogenous "causal" variables for the latent factors. More complex SEM models allow for feed-back mechanisms where that some of these causal factors not only influence human development but they are also influenced by it. Previous papers which utilize Structural Equation Models to estimate well-being within a capability framework include the following: Kuklys (2004), Di Tommaso (2007b), Krishnakumar (2007). The seminal contribution by Kuklys (2004) contains the first theoretical model of capabilities applied to SEM.

¹¹ In contrast with this result, Jenkins and Schluter (2002) find that in Germany late childhood income effect on child's outcomes is higher than early-childhood income.

Ballon and Krishnakumar (2006) utilise SEM to estimate the capability of being able to be educated and to be adequately sheltered on Bolivian data. Di Tommaso (2007b) The second paper estimate the well-being of Indian children (defined over malnutrition, schooling and work indicators).

The principal advantage of this approach is that it does not rely on exact measurement of the capability. Each indicator represents a noisy signal of it. This modelling strategy has been extensively used in psychometrics and more recently in econometrics (see for example Di Tommaso et al. 2007), and is founded upon the specification of a system of equations which establishes the relationship between an unobservable latent variable, a set of observable endogenous indicators and a set of observable exogenous variables (which are believed to be the causes of a specific capability).

This approach builds upon the early work of Joreskog and Goldeberger (1975) and Zellner (1970) and has been formalized in the LISREL (Linear Structural Relationships) model of a set of linear structural equations.¹²

The MIMIC approach allows us to think of this model as comprising two parts: 2 structural equations, one for the capability of Senses Imagination and Thought (SIT) and one for the capability of Leisure and Play Activities (LPA) (which relates the 2 latent capability variables to the causes) and two measurement equations that each capability is measured by many indicators.

For each of the indicators chosen to represent a latent construct, a weight (a factor loading) will be estimated. This weight represents how much that specific functioning counts in explaining the latent variable (either SIT or LPA) relative to other functionings.

¹² An excellent review of the literature is to be found in Bentler and Weeks (1980) and Aigner, Hsiao, Kapteyn, and Wansbeek (1984), and Wansbeek and Meijer (2000).

4.1 Model Specification

The structure of the model is as follows:

$$\begin{aligned} Y^I &= \Lambda^{Y^I} Y_1^* + \varepsilon_1 \\ Y^II &= \Lambda^{Y^II} Y_2^* + \varepsilon_2 \end{aligned} \quad (1)$$

where $Y^I = (Y_1^I, Y_2^I, Y_3^I, \dots, Y_m^I)$ is a vector with m elements representing an unobserved independent indicator of the SIT capability Y_1^* .

$Y^II = (Y_1^{II}, Y_2^{II}, Y_3^{II}, \dots, Y_m^{II})$ is a vector with n elements representing an unobserved independent indicator of the LPA capability Y_2^* .

$\Lambda^{Y^I} = \{\Lambda^{Y^I}_1, \Lambda^{Y^I}_2, \Lambda^{Y^I}_3, \dots, \Lambda^{Y^I}_m\}$ denotes a $m \times 1$ parameter vector of factor loadings, with each element representing the expected change in the respective indicators following a one unit change in the latent variable Y_1^* .

$\Lambda^{Y^II} = \{\Lambda^{Y^II}_1, \Lambda^{Y^II}_2, \Lambda^{Y^II}_3, \dots, \Lambda^{Y^II}_m\}$ denotes a $n \times 1$ parameter vector of factor loadings, with each element representing the expected change in the respective indicators following a one unit change in the latent variable Y_2^* .

ε_1 is a $m \times 1$ vector of measurement errors, with Θ_{ε_1} denoting the covariance matrix and ε_2 is a $n \times 1$ vector of measurement errors, with Θ_{ε_2} denoting the covariance matrix.

Moreover we let these two capabilities to be correlated with correlation coefficient equal to $\rho_{\varepsilon_1 \varepsilon_2}$

In addition we posit that the latent variables Y_1^* and Y_2^* are linearly determined by a common vector of observable exogenous variables $x = (x_1, x_2, \dots, x_s)$ and a stochastic error $\zeta = (\zeta_1, \zeta_2) =$ giving,

$$\begin{aligned} Y_1^* &= x' \gamma_1 + \zeta_1 \\ Y_2^* &= x' \gamma_2 + \zeta_2 \end{aligned} \quad (2)$$

where γ_1 and γ_2 are $s \times 1$ vector of parameters.

Examining (1) and (2) we may think of our model as comprised of two parts: (2) is the structural equation and (1) is the measurement equation reflecting that the observed measurements are imperfect indicators. The structural equation specifies the casual relationship between the observed exogenous causes and the two capabilities. Combining (1) and (2) the reduced form representation is written as

$$\begin{aligned} Y^I &= \pi_1 x' + v_1 \\ Y^{II} &= \pi_2 x' + v_2 \end{aligned} \quad (3)$$

where $\pi_1 = \Lambda^{Y^I} \gamma_1'$ is the $m \times s$ reduced form coefficient matrix for SIT, $\pi_2 = \Lambda^{Y^{II}} \gamma_2'$ is the $n \times s$ reduced form coefficient matrix for LPA. $v_1 = \Lambda^{Y^I} \zeta_1 + \varepsilon_1$ and $v_2 = \Lambda^{Y^{II}} \zeta_2 + \varepsilon_2$ are the reduced form disturbance.

The application of this model to our data set will allow us to estimate the parameter γ_1 and γ_2 , the factor loadings (weights of each indicator in the respective latent variables) Λ^{Y^I} , $\Lambda^{Y^{II}}$, and the correlation coefficient $\rho_{\varepsilon_1 \varepsilon_2}$.

5. The Data

The capabilities “Senses, Imagination and Thought” and “Leisure and Play Activities ” that are the object of our analysis on child well being in Italy cannot be measured directly since primary data sources are not currently available and we are therefore forced to use secondary data source. However our analysis on available surveys on children’s well being in Italy shows that not all the variables that the literature shows to be relevant in affecting the chosen dimensions of child well being are available in one data set. Therefore, in order to measure child well being with secondary data, we have used two sources of data to recover as much information on the observables functionings of the two capabilities and on the conversion factors. The first data set used is the ISTAT (Italian National Statistical Office) multipurpose survey on family and on children condition (FSS98), this data set provides us information on children’s education, play and leisure activities, the socio-demographic structure of their families, child care provided by relatives and parents according to the type of activities in which the children are involved. However FSS98 lacks information on family income that can be considered as an important factor affecting child well being and that we have recovered by using propensity score matching techniques, matching ISTAT 1998 FSS (Famiglie, Soggetti Sociali e Condizione dell’Infanzia) with Bank of Italy 2000 SHIW (Surveys on Household Income and Wealth). For this purpose we have used in Addabbo, Di Tommaso, Maccagnan and Morciano (2007) a micro procedure inspired by propensity score matching (Rubin, 1977; Rosembaum, Rabin, 1983; Dehejia, Wahba, 1999) and in this paper we use the matched data set constructed.

The resulting data set (BFSS98 in the following) contains information about children aged from 3 to 13 who live in families where both parents are present. The number of children is equal to 2,031 children (1,011 girls and 1,020 boys).

Amongst them 20% live in one-child families. The probability of living in a one-child household is higher in the North-East of the country, while families with a high number of children are more likely to be found in the Islands.

Turning to the type of family where the children live (according to their parents' employment condition) 46% of children live in double-earner households and 47% in one earner households where the father is employed, 2.15% where only the mother is employed and 4.78% of the children live in households where both parents are unemployed. The double-earner model is more spread in Centre-North whereas one-earner traditional type of households are more spread in the South where double-unemployed families are more likely to be found too. By analysing fathers' employment condition we can see that 94% is employed (36% blue collar and 25% self-employed). Amongst father 9% are in managerial positions and 4.3% is unemployed. On the other hand more than 50% of mothers are housewives, 22% are white-collar and 13% blue collar. Only 2.4% are manager and 8.9% self-employed. (Tab.5.1).

The data set provides us information on the type of school attended by children, children living in the South of Italy have a lower probability of attending a private school (Table 5.2), whereas the percentage of children attending private school is higher than average in the North and in the Centre of Italy for primary school and in the North west and Centre for secondary school. Another relevant dimension is how long children stay at school (Tab.5.3): average number of hours in school is higher in primary than in secondary school and the gap is in favour of private school in both primary and secondary school. Average number of hours in school decreases from the North to the South of the country in public school.

Section 6 . Measuring functionings of “Senses, Imagination and Thought” and “Leisure and Play Activities ” dimensions of children well being in Italy

The capabilities that have been chosen as a focus of children’s well being in this paper are crucial not only in determining actual children’s well being but also in affecting well being later in their life. In this section we will use the available secondary source data set in order to measure their observable functionings and their interaction with family characteristics.

We have restricted our attention to the sample of 1,626 children (52% female) aged from 6 to 13. BFSS98 provide us information on children’s attitude towards education. Descriptive statistics by sex show higher values in terms of attitudes towards education for girls than for boys in terms of efforts and results obtained.

We have controlled for a set of observables environmental and individual variables by estimating ordered probit models on the attitudes towards education separately for children aged 6 to 10 (in elementary school age) and aged 11 to 13 (secondary school age). The model estimated for children aged 6 to 10 (Tab.6.2) shows that being a girl positively affects (controlling for other individual, family and area variables) the attitudes towards education. The higher is the number of children in the family the lower is the attitude of the child towards education. Looking at the type of school and the number of hours in school the model shows a positive impact on attitudes towards education of a higher number of hours in school and of being enrolled in a private school. The attitude towards education improves if the child does her homework alone or with her mother. Looking at parents’ employment condition only mother’s number of hours of work (paid and unpaid) affects her child’s education attitude (it decreases if mothers are in a managing position and increases with the increase in paid and unpaid working hours – however the latter may include hours

spent by women in controlling children's homework). Child's attitude towards education improves if her mother has a degree. A positive impact on 6 to 10 years old attitude towards education is achieved when there is a high level of interaction between parents. The latter is defined by observing parents going to restaurant, cinema, for a walk, visiting relatives, friends or spending week-ends out together.

Turning to the educational attitude shown by children aged 11-13 (Tab.6.2) one can notice that for children in this age group the educational attitude is still affected by child's gender (girls still show a more positive attitude towards education) but becomes also negatively related to the absence from school (when children made more than 59 days of absence from school) still positively related to being enrolled in a private school and not related to the hours spent in school (notice however that in this type of school one can observe a smaller variability in the time spent at school than in elementary schools). Differently from the effects of the same factors on children aged 6-10, mothers having a degree affect positively but not significantly their children's attitudes towards education and the other variables that are found to significantly affect this attitude are doing homework alone or with father.

Together with child's educational attitude another functioning of the "Senses, Imagination and Thought" that we can observe in BFSS98 is the paid and unpaid attendance of other activities not at school. Descriptive statistics show a high degree of variation in this variable (Tab.6.3) across region.

The probability of attending paid activities (music, painting, sport, languages, computer) not run by the school (Tab.6.4) significantly decreases for children in both age groups with their attendance to other unpaid activities not run by the school and, only for children aged from 11 to 13, significantly increases if the child attends experimental classes and does homework alone. A higher presence of kindergartens is found to positively affect the attendance of paid activities for both age groups, this

probably may be related to the development in early age of a higher experience in doing other activities (like painting, music...) by the higher probability of attending kindergarten that children living in regions where kindergarten are more spread have.

We assume that the sum of weekly hours in activities (painting, music, singing, theatre, dance, sport, school magazine, and other) is a measure of a functioning of the cognitive capabilities. On average taking the whole sample, Italian boys aged from 6-13 spend 2 hours a week in sports and girls 1 hour (the average number of hours being higher in the Centre North than in the South of Italy), girls outweigh boys in the average number of hours in music and dance courses (Tab.6.5).

In order to proxy functionings of the capability “Leisure activities and Play” we have used the variables in BFSS98 data set on the frequency children play with their parents, meet children of their age, go to the park and their most frequent type of game. We can also observe with whom they play during week days and during week ends. Descriptive analysis on this set of variables (Tab.6.6) shows variability by sex and by area where the children live. A similar relatively low percentage of children by sex go to play in the park at least once a week, more in the Centre North than in the South of Italy. More boys than girls play at least sometimes a week with the father in the Centre North of Italy while more girls than boys play at least sometimes with the father in the South of Italy. More boys than girls play at least sometimes a week with their mother in the Centre North than in the South of Italy where 84% of girls and 77% of boys play at least sometimes in a week with their mother. The frequency children meet other children of the same age is higher in the Centre North of Italy and higher for boys than for girls. The most frequent game, a part for boys living in the South of Italy, are movement games (more than 60% of children living in the Centre North against 28% of girls living in the South and 38% of boys living in the South, the latter show a higher percentage of videogame as most frequent type of game). Almost 40% of boys and girls play alone during week days against 32% of girls and

26% of boys in the South of Italy (this has to do probably with the higher number of only one child families in the Centre and North of Italy than in the South).

We have defined a new indicator whose values increase with the frequency children play either with the parents or with peers. A multivariate analysis on this indicator that relates it to family and child's characteristics for children aged from 6 to 10 (Tab.6.7) shows how the frequency of play with parents or peers is lower the higher is the number of hours at school and when the child has been absent from school for more than 59 days, whereas it increases in connection with a higher number of hours spent by mothers in unpaid care and housework activities and the higher is her level of education (the latter being probably connected with a higher attention to playing time with her child). How often does the child play with her parents or peers is negatively affected by household equivalent income and by the number of children in it.

7. MIMIC model

We have estimated the model described in Section 4 above on the data set described in Section 5.

The main regression results are presented in Table 7.1. We report 3 specifications: Specification 1 includes the log of family income but excludes parents education dummies; Specification 2 includes parents education dummies and excludes income; Specification 3 include both family income and parents education dummies. First of all we note that the 3 specifications show similar results, implying that the estimates of the coefficients of the covariates and the factor loading of the latent variable are robust to different specifications. Our preferred specification is the 3rd one because it includes both income and parents education variables and it shows that controlling for parents education, income becomes not significantly different from 0.

Part a) of Table 7.1 reports regression coefficients of the structural equations for the two capabilities studied.

First we analysed the results for the Senses Imagination and Thought capability. The coefficients show a negative and significant effect of being male and of the number of siblings, whereas there is a positive and significant effect of mother's paid and unpaid hours of work and if the father is graduated. In Spec.1 the log of family income is significant but when we include parents education dummies than it loses importance.

As far as the parameters of the covariates on the capabilities of Leisure and Play activities are concerned we note that being a boy and hours of school have a strong positive effect while coming from the South and the number of sibling have a negative effect.

Note that parents education dummies are not significant in all the specification with the exception of father secondary school dummy in the capability of Leisure and Play activities.

Part b of Table 7.1 presents estimates of the factor loadings for each of the components of the capability of Senses Imagination and Thought in the measurement equation. It shows that attitude towards education performing artistic activities has the highest impact over the capability of Senses Imagination and Thought followed by attitude towards education and other activities.

The third part of Table 7.1 (Table 7.1.c) shows the estimates of the factor loadings for the components of the capability of Leisure and Play. Here the most important indicators are the dummy for sport, for games which imply physical activities but also playing with videogames, lego and playground activities play an important role.

As far as the squared multiple correlation for the latent variables is concerned (R^2), it indicates to what extent the common factors account for the variance of the indicators or how closely the model fits the data see Table 7.1 d. Specification 3 is

the one that has the highest R squared. This is quite obvious because it includes more variables than Specification 1 and 2.

The correlation coefficient among the latent variables is positive and significantly different from 0.

8. Conclusions

In this paper we deal with the problem of measuring children well being by using the capability approach and in particular with regards to two capabilities: “Senses, Imagination and Thought” and “Leisure activities and Play”.

We have faced different challenges: first, the type of data necessary to measure these capabilities, second, which type of modelling structure to adopt. To tackle the first challenge, we have used a data set (BFSS98) that has been created by matching two different data sets: Bank of Italy Survey on Income and Wealth (SHIW2000) and Istat Families, social subjects and childhood condition (FSS98). As far as the second issue is concerned, we have adopted a Structural Equation modelling (SEM) approach because capabilities are intrinsically unobserved construct of which we can only measure some indicators and SEM allow to deal with this latent variables in a sufficiently flexible way.

Our results are very robust to different specifications. A strong implication of our results is the strong gender effect in Italy: being a boy implies both a negative effect on the capability of Senses Imagination and Thought and a positive effect on Leisure and playing activities. These two capabilities are also negatively affected by the number of siblings in the household, after having controlled for family income and parents hours of paid and unpaid work. After controlling for parents education, family income loses importance in determining children capabilities.

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Table 5.1 – Parents level of education and employment status children aged from 3 to 13

Education	Mother	Father
Primary school	12.62%	9.88%
Secondary	46.97%	50.61%
High School	30.56%	29.37%
Degree	9.85%	10.14%
Employment condition	Mother	Father
Not employed	53.04%	6.05%
<i>Retired</i>	0.76%	1.39%
<i>Unemployed</i>	1.78%	4.31%
<i>Student</i>	0.04%	0.22%
<i>Housewife</i>	50.42%	0.11%
Employee	38.08%	68.08%
<i>Blue collar</i>	12.85%	36.50%
<i>White collar</i>	22.82%	22.38%
<i>Manager</i>	2.40%	9.13%
Self-employed	8.88%	25.96%
<i>Entrepreneur/professional</i>	2.77%	11.77%
<i>Self employed</i>	5.38%	13.59%
<i>Co.co.co.</i>	0.63%	0.60%

Source: our elaboration on BFSS98 data.

Table 5.2 Type of private school attended by area. Children aged 6 to 13

Private school	Primary	Secondary
North West	10%	8%
Nort East	10%	4%
Centre	8%	13%
South	3%	1%
Islands	1%	6%
Total	7%	6%

Source: our elaboration on BFSS98 data.

Table 5.3.a Weekly hours of school attended by children, type of school and area – Primary school

Type of school	Primari Private		Primary Public		gap priv-pub
	Mean	S.D.	mean	S.D.	
North West	34	9.5	32	5.6	2
Nort East	32	8.0	32	5.5	0
Centre	34	4.0	31	5.4	3
South	37	5.0	30	5.3	7
Islands	34	4.5	29	5.2	5
Total	34	8	31	6	3

Source: our elaboration on BFSS98 data.

Table 5.3.b Weekly hours of school attended by children, type of school and area – Secondary school

Type of school	Secondary Private		Secondary Public		gap priv-pub
	Mean	S.D.	mean	S.D.	
North West	37	5.7	32	5.0	5
Nort East	32	7.9	32	4.4	0
Centre	33	9.2	31	4.5	2
South	37	5.0	30	4.7	7
Islands	30		30	3.7	0
Total	32	7	31	4.6	1

Source: our elaboration on BFSS98 data.

Tab.6.1a Attitudes towards education by sex. Children aged from 6 to 10

	girls	boys
Indolent, no effort	1.9%	3.9%
Only some topics he/she likes	7.8%	11.1%
Enough effort to pass the mark	15.4%	18.8%
Results more than mark, but can do more	34.1%	37.9%
High effort and excellent results	40.9%	28.3%
	100%	100%
	434	503

Source: Our elaboration on BFSS98 data

Tab.6.1b Attitudes towards education by sex. Children aged from 11 to 13

	girls	boys
Indolent, no effort	2.0%	4.1%
studies only some topics he/she likes	10.8%	9.4%
enough effort to pass the mark	14.2%	24.0%
results more than mark, bu can do more	29.7%	30.4%
high effort and excellent results	43.3%	32.1%
	100%	100%
	301	280

Source: Our elaboration on BFSS98 data

Tab.6.2 Ordered Probit estimates on the attitudes towards education

	6 to 10	11 to 13
Boy	-0.345** (-3.27)	-0.237 (-1.77)
Centre North	0.166 (0.74)	-0.259 (-0.78)
Number of brothers or sisters (child included)	-0.199* (-2.16)	-0.186 (-1.54)
absent from school for more than 59 days	-0.269 (-0.70)	-0.400 (-1.66)
weekly hours of school	0.018 (1.71)	-0.008 (-0.60)
private school	0.353 (1.65)	0.857** (3.67)
Experimental class	0.123 (0.70)	-0.029 (-0.16)
Homework with father	-0.082 (-0.63)	0.368 (1.93)
Homework with mother	0.254* (2.30)	-0.007 (-0.05)
Homework with brothers/sisters	0.182 (1.05)	-0.143 (-0.60)
Homework alone	0.199 (1.89)	0.363* (2.40)
Father white collar	-0.118 (-0.71)	0.329 (1.57)
Father manager	0.319 (1.39)	0.283 (1.25)
Father self-employed	-0.202 (-1.27)	0.139 (0.71)
Mother white collar	0.087 (0.48)	-0.313 (-1.37)
Mother manager	-0.526 (-1.85)	-0.712* (-2.13)
Mother self-employed	0.210 (1.04)	-0.182 (-0.56)
Father unemployed	0.088 (0.23)	-0.015 (-0.03)
Mother unemployed	0.630 (1.58)	0.016 (0.04)
mother housewife	0.147 (0.71)	-0.110 (-0.38)
Father graduated	0.019 (0.10)	-0.194 (-0.78)
Father high school	0.124 (0.95)	-0.179 (-0.95)
Mother graduated	0.488* (2.21)	0.352 (1.18)
Mother high school	0.039 (0.29)	0.096 (0.46)
Log equivalent household income	0.049 (1.02)	-0.085 (-0.87)
Father's weekly paid hours of work	0.005	-0.001

	(1.30)	(-0.18)
Mother's weekly paid hours of work	0.018**	0.003
	(2.99)	(0.36)
Mother's weekly unpaid hours of work	0.037*	0.004
	(2.02)	(0.13)
incidence of kindergarten in the region	0.080	0.259
	(0.53)	(1.11)
High interaction between parents	0.391	-0.194
	(1.70)	(-0.56)
Observations	940	566
Robust z statistics in parentheses		
* significant at 5%; ** significant at 1%		

Source: Our elaboration on BFSS98 data

Tab.6.3.a Paid activities attendance by sex and area – Children aged 6-10

Area	Girl	Boy
North West	57%	39%
North East	64%	44%
Centre	45%	48%
South	20%	34%
Islands	25%	17%
Total	42%	37%
Obs	481	534

Source: Our elaboration on BFSS98 data

Tab.6.3.b Paid activities attendance by sex and area – Children aged 11-13

	Girl	Boy
North West	48%	53%
North East	55%	45%
Centre	59%	39%
South	25%	30%
Islands	20%	29%
Total	41%	39%
Obs	310	301

Source: Our elaboration on BFSS98 data

Tab. 6.4 Probit models on paid activities attendance by child's age

	age 6-10	age 11-13
Boy	-0.110	0.096
	(-1.00)	(0.64)
Attend other unpaid activities not run by school	-1.241**	-1.196**
	(-5.02)	(-4.33)
Attends other school activities	0.636**	-0.176
	(4.28)	(-0.95)
Lognidi	0.292**	0.325*
	(2.89)	(2.43)
Number of children in the family	-0.020	-0.179

	(-0.20)	(-1.25)
School weekly hours	0.005	-0.006
	(0.45)	(-0.39)
More than 59 days absent from school	-0.416	-0.159
	(-1.63)	(-0.42)
Private School	-0.199	0.173
	(-0.83)	(0.55)
Experimental courses	0.176	0.522*
	(0.75)	(1.97)
Homework with father	-0.026	0.233
	(-0.16)	(1.11)
Homework with mother	0.036	0.270
	(0.29)	(1.67)
Homework with sisters/brothers	-0.117	-0.247
	(-0.54)	(-0.99)
Homework alone	-0.041	0.457**
	(-0.33)	(2.70)
Father white collar teacher	0.253	0.211
	(1.53)	(0.92)
Father manager	0.442	0.225
	(1.75)	(0.71)
Father self-employed	0.020	-0.290
	(0.13)	(-1.27)
Mother white collar-teacher	0.364	0.087
	(1.76)	(0.33)
Mother manager	-0.471	0.769
	(-1.25)	(1.17)
Mother self-employed	0.371	0.305
	(1.45)	(0.92)
Father unemployed	0.012	0.141
	(0.03)	(0.31)
Mother unemployed	0.077	0.246
	(0.16)	(0.35)
Mother housewife	0.301	-0.022
	(1.05)	(-0.06)
Father's degree	0.163	0.437
	(0.73)	(1.46)
Father's high school diploma	0.109	0.042
	(0.75)	(0.20)
Mother's Degree	0.047	-0.344
	(0.18)	(-1.10)
Mother's high school diploma	-0.034	0.094
	(-0.24)	(0.49)
Log equivalent family income	0.048	-0.052
	(0.73)	(-0.45)
Father's paid weekly hours	0.005	0.002
	(1.15)	(0.31)
Mother's paid weekly hours	-0.003	-0.005
	(-0.43)	(-0.66)
Mother's unpaid weekly hours	-0.013	-0.011
	(-0.78)	(-0.44)
Constant	1.416	3.307
	(1.26)	(1.96)
Observations	1,012	608

Robust z statistics in parentheses

* significant at 5%; ** significant at 1%

Source: Our elaboration on BFSS98 data

Tab.6.5a – Average weekly hours in activities – whole sample by age group and sex
Italy

age	age 6-10				age 11-13				
	Hours in	M	F	Gap	ttest	M	F	gap	Ttest
school									
magazine	0.02	0.005	0.015	-0.05	0.008	0.007	0.001	-1.18	
other									
activities	0.07	0.06	0.01	0.95	0.04	0.11	-0.07	0.69	
computing	0.11	0.1	0.01	-0.82	0.09	0.07	0.02	0.22	
languages	0.08	0.11	-0.03	-0.91	0.22	0.07	0.15	-1.91	
gym	2.13	1.3	0.83	-5.7	1.98	1.17	0.81	-3.91	
painting	0.008	0.05	-0.042	-1.49	0.08	0.12	-0.04	0.78	
theatre	0.11	0.03	0.08	-1.38	0.11	0.06	0.05	-0.001	
dance	0.03	0.25	-0.22	5.26	0.01	0.36	-0.35	3.9	
music	0.15	0.47	-0.32	3.25	0.25	0.3	-0.05	1.68	
sing	0.05	0.05	0	-0.13	0.07	0.12	-0.05	1.68	
obs	534	481			301	310			

Tab.6.5b – Average weekly hours in activities – whole sample by age group and sex

Centre-North

age	age 6-10				age 11-13				
	Hours in	M	F	gap	ttest	M	F	gap	Ttest
school									
magazine	0.02	0.005	0.015	0.86	0	0.01	-0.01	0.94	
other									
activities	0.005	0.07	-0.065	1.79	0.04	0.17	-0.13	1.13	
computing	0.16	0.08	0.08	-0.92	0.09	0.07	0.02	0.2	
languages	0.08	0.15	-0.07	1.14	0.23	0.09	0.14	-2	
gym	2.6	1.73	0.87	-4.23	2.47	1.68	0.79	-2.96	
painting	0.01	0.06	-0.05	1.08	0.06	0.09	-0.03	0.76	
theatre	0.17	0.04	0.13	-1.38	0.06	0.09	-0.03	1.63	
dance	0.008	0.25	-0.242	5.02	0.02	0.39	-0.37	2.68	
music	0.13	0.42	-0.29	2.63	0.22	0.29	-0.07	1.03	
sing	0.06	0.08	-0.02	0.64	0.05	0.13	-0.08	1.64	
obs	296	258			160	180			

Tab.6.5c – Average weekly hours in activities – whole sample by age group and sex

South

age	age 6-10				age 11-13				
	Hours in	M	F	gap	ttest	M	F	gap	Ttest
school magazine	0.02	0.006	0.014	-0.76	0.02	0	0.02	-1.45	
other activities	0.17	0.05	0.12	-0.78	0.04	0.03	0.01	-0.89	
computing	0.03	0.14	-0.11	-0.01	0.09	0.06	0.03	-0.03	
languages	0.1	0.04	0.06	-2.07	0.21	0.04	0.17	-1.09	
gym	1.39	0.67	0.72	-3.8	1.23	0.48	0.75	-2.94	
painting	0.006	0.02	-0.014	1.22	0.12	0.15	-0.03	0.37	

theatre	0.008	0.02	-0.012	-0.12	0.17	0.03	0.14	-1.19
dance	0.07	0.25	-0.18	2.39	0.009	0.31	-0.301	3.02
music	0.17	0.53	-0.36	1.99	0.29	0.31	-0.02	1.37
sing	0.03	0.01	0.02	-0.98	0.09	0.11	-0.02	0.68
obs	238	223			141	130		

Tab.6.6 – Playing activities by sex and area – Children aged from 6 to 10

	Italy		CentreNorth		South	
	girls	boys	girls	boys	girls	boys
park at least once a week	33%	31%	38%	38%	29%	22%
play with father at least sometimes a week	59%	68%	54%	70%	69%	65%
play with mother at least sometimes a week	72%	74%	67%	72%	84%	77%
meet pairs at least sometimes a week	66%	75%	71%	79%	51%	70%
play alone during the week	36%	34%	39%	39%	32%	26%
play alone during holidays	32%	26%	34%	27%	32%	22%
more frequent game videogame	26%	37%	27%	32%	22%	42%
more freq.game building	15%	25%	13%	25%	17%	26%
parlours game	29%	27%	37%	28%	15%	19%
role game	4%	4%	4%	5%	5%	2%
movement game	48%	52%	61%	64%	28%	38%
Drawing	21%	12%	18%	10%	28%	14%
Housework	1%	0%	1%	0%	2%	0%
Toys	6%	5%	4%	5%	8%	5%
Obs	376	421	236	272	140	149

Table 6.7 – How often does the child play with his parents and peers
Ordered Probit – variable is increasing the higher is the frequency of play

Ordered Probit on Play with parents and peers frequency	
	6 to 10
Boy	-0.103 (-1.08)
Centre North	0.015 (0.07)
Number of children in the family	-0.190* (-2.05)
more than 59 days absent from school	-0.656* (-2.05)
weekly hours of school	-0.015 (-1.64)
Father white collar	-0.097 (-0.68)
Father manager	-0.012 (-0.06)
Father self employed	-0.004 (-0.03)
Mother white collar	0.028 (0.15)
Mother manager	-0.324 (-1.14)
Mother self employed	0.150 (0.69)
Father unemployed	-0.217 (-0.95)
Mother unemployed	0.183 (0.59)
Mother housewife	-0.132 (-0.60)

Father degree	0.050 (0.27)
Father high school	0.047 (0.37)
Mother degree	0.374 (1.84)
Mother high school	0.119 (0.93)
Log equivalent family income	-0.160** (-3.05)
Father's paid working hours	-0.001 (-0.41)
Mother's paid working hours	0.006 (1.03)
Mother's unpaid working hours	0.037* (2.26)
regional incidence of kindergarten	0.010 (0.07)
Observations	938
Robust z statistics in parentheses	
* significant at 5%; ** significant at 1%	

Source: our elaboration on BFSS98 data.

Table 7.1a: Regression Coefficients of the structural equations: γ_1, γ_2

	Senses Imagination and Thought			Leisure and play activities		
	Spec 1	Spec 2	Spec 3	Spec 1	Spec 2	Spec 1
Eta ²	-0.006 0.010	-0.002 0.011	-0.002 0.011	-0.007 0.013	-0.003 0.013	-0.003 0.013
Num siblings	-0.143** 0.042	-0.194** 0.044	-0.185** 0.045	-0.086* 0.048	-0.101** 0.051	-0.096 * 0.051
Boy=1; 0 otherwise	-0.363** 0.053	-0.400** 0.055	-0.394** 0.055	0.370** 0.060	0.366** 0.061	0.372 ** 0.061
School hours per week.	0.003 0.004	0.004 0.005	0.004 0.005	0.017** 0.006	0.018** 0.006	0.017** 0.006
Father's unpaid domestic working hours	-0.018* 0.010	-0.021* 0.011	-0.019 0.011	-0.007 0.013	-0.008 0.013	-0.006 0.013
Father's paid working hours	0.000 0.002	0.001 0.002	0.001 0.002	-0.001 0.002	0.000 0.002	0.000 0.002
Mother's unpaid domestic working hours	0.016* 0.009	0.026** 0.010	0.024** 0.010	-0.012 0.011	-0.009 0.012	-0.011 0.012
Mother's paid working hours	0.006** 0.003	0.008** 0.003	0.007** 0.003	0.000 0.003	0.000 0.004	-0.001 0.004
Dummy South=1; 0 otherwise	-0.030 0.058	-0.056 0.061	-0.046 0.061	-0.326** 0.077	-0.353** 0.077	-0.338** 0.078
Log. Family income	0.054** 0.021		0.030 0.022	0.051* 0.027		0.027 0.028
Dummy Father degree=1; 0 otherwise		0.178 0.103	0.167 0.102		0.158 0.114	0.148 0.115
Dummy Mother degree=1; 0 otherwise		0.205* 0.107	0.184 0.107		-0.016 0.128	-0.029 0.129
Dummy secondary school mother		0.066 0.060	0.056 0.060		0.017 0.070	0.013 0.070
Dummy secondary school father		0.041 0.059	0.032 0.059		0.252** 0.071	0.242** 0.072
Number of Obs.	1504	1504	1504	1504	1504	1504

*Significant at 10% level. ** Significant at 5% level.

The first row for each variable is the coefficient and the second is the standard error.

The base category is lower education respect to degree, Centre-North.

Table 7.1 b

Estimates of the “loadings” for each of the components of the latent variable **Senses Imagination and Thought** in the measurement equation $\Lambda^{y'}$

	Senses Imagination Thought		
	Spec 1	Spec 2	Spec 3
Attitude towards education	1	1	1
	0	0	0
Dummy artistic activities=1; 0 otherwise	1.096 (0.207)**	0.933 (0.183)**	0.952 (0.188)**
Dummy other activities=1; 0 otherwise	0.693 (0.167)**	0.544 (0.153)**	0.578 (0.156)**

*Significant at 10% level.** Significant at 5% level.

Table 7.1 c

Estimates of the “loadings” for each of the components of the latent variable **Leisure activities and Play** in the measurement equation $\Lambda^{y''}$

	Leisure and Play Activities		
	Spec 1	Spec 2	Spec 3
Dummy sport activities=1; 0 otherwise	1	1	1
	0	0	0
Dummy playing videogames=1; 0 otherwise	0.351 (0.106)**	0.326 (0.105)**	0.347 (0.106)**
Dummy playing board games=1; 0 otherwise	0.244 (0.104)**	0.292 (0.100)**	0.276 (0.100)**
Dummy playing lego type games=1; 0 otherwise	0.281 (0.115)**	0.244 (0.109)**	0.240 (0.110)**
Dummy playing active games=1; 0 otherwise	0.517 (0.113)**	0.504 (0.107)**	0.497 (0.108)**
How often play in playground=1 if everyday;=6 never	-0.296 (0.085)**	-0.314 (0.081)**	-0.305 (0.081)**

*Significant at 10% level.** Significant at 5% level.

Table 7.1 d: Latent Variables R-Square, and correlation coefficients among latent variables

	Spec 1	Spec 2	Spec 3
Senses Imagination and Thought	0.252	0.273	0.275
Leisure and Play Activities	0.390	0.404	0.406
Correlation coefficient among latent variables	0.129 (0.026)**	0.141 (0.063)**	0.139 (0.027)**

*Significant at 10% level.** Significant at 5% level.

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