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ORIGINAL ARTICLE

Peer effects on youth screen media consumption in Catalonia (Spain)

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Abstract It is well known that young people are major consumers of screen media and that their peers are one of the principal determinants of youth behavior as regards their patterns of consumption and other activities. On the basis of these premises, the purpose of this paper is to analyze the influence of classroom peers on youth screen media consumption. More specifically, it considers the time spent watching TV, playing console games and surfing the Internet. Data are drawn from a single representative survey of secondary school students aged 14–16 in Catalonia (Spain) in 2008. Having accounted for problems of endogeneity, our analysis shows that peer consumption has a positive and statistically significant effect on an individual's console and Internet use. While the magnitude of this effect is not great in the case of the former use, peer effects are quite marked in that of Internet consumption. Moreover, gender differences are observed when media consumption is examined separately. Thus, peer effects on console use are statistically significant only for boys, while the influence of peers on an individual's Internet use is higher among boys than it is among girls.

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1 Introduction

Expenditure on screen media in Spain has increased sharply in recent years. Between 2000 and 2008, household spending on Internet connection fees grew from 0.4 to 16.2 % of total cultural spending, whereas the purchase of television and video equipment rose from 8.6 to 11.3 % of cultural spending (MC 2010). At the same time, the media sector has come to play a major role within the productive sectors of Spain's cultural industry. Thus, in 2008, the audiovisual sector (cinema, video and television) accounted for 27.5 % of the cultural gross domestic product (MC 2010), while the video game market has become particularly dominant, with Spain currently being ranked fourth in Europe in terms of sales (GfK Emer Ad-Hoc Research 2010). Spanish youth play a leading role in this market, being the main consumers of screen media, such as video games, TV programs and the Internet. Indeed, as in other European countries, the media and new technologies are the most widely consumed cultural goods among Spanish teenagers (Interarts 2010). Thus, media consumption seems relevant in economic terms, and young people have an important role in this type of consumption. Therefore, the influence of peers may play a decisive role.

Within the framework, this paper seeks to analyze the importance of school-based peer influences in determining the screen time consumption of young people (aged 14–16) in Catalonia, an autonomous community of Spain. Specifically, we consider the time consumption of television, console games and Internet.

The main novelty of our study is the analysis it undertakes of peer effects on the time devoted to screen media by adolescents (a topic unexplored to date, to the best of our knowledge). Moreover, it is our belief that this study places the variable 'peers' into much sharper focus than has been achieved in most earlier studies, with peer groups being constructed on the basis of information provided by students who are allowed to nominate their friends in the classroom. In addition, in the regression analysis we control for endogeneity through the use of instrumental variables estimations. Finally, we simultaneously consider the influence of variables from different environments (personal, family, class and school).

The remainder of this paper is organized as follows. In the next section, we provide an overview of the relevant literature on the youth consumption of screen products as well as on the effect of peers on an individual's behavior. Section 3 describes the data and the econometric strategy followed in this study. Section 4 contains the main results, and a final section provides the conclusions.

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2 Youth screen media consumption: a review of the literature

In this section, we show some evidence related to time spent on the consumption of screen media as well as a review of international studies that analyze the factors that increase this type of consumption.

Recent data from the Spanish Ministry of Culture shows that 92.3 % of teenagers (15–19-year-olds) watch television on a daily basis and 80.9 % (15–24-year-olds) access the Internet. Although playing video games is a less widespread practice, young people (15–24-year-olds) are their main consumers. Thus, 10.4 % of Spanish youngsters claim to play video games every day, and 34.3 % at least once a week (MC 2010).

International studies report an average daily time spent on screen media consumption (i.e., TV, computer and videogames) of between 3 and 4 h in the USA, Canada, Australia, New Zealand and Europe: around 2 h and 30 min of TV, 30–40 min of video games and a further 45 min approximately of computer use (see a review of studies in Marshall et al. 2006, and Devís-Devís et al. 2009). In Spain, the Survey of Cultural Habits and Practices in Spain (2010–2011) reports, on average, that teenagers (15–19-year-olds) watch TV for 141 min per day (almost 2 h and 30 min) and spend almost 1 h and 30 min on the Internet—see MC (2011). In addition, Tabernero et al. (2010) show that the teenagers (12–18-year-olds) play video games around 45 min per day. Similarly, Bercedo et al. (2005) point out that in Cantabria (a region in northern Spain), young people aged 14–16 consume 3 h of TV, and almost 2 of video games and Internet every day. In Catalonia (a region in northeastern Spain), FUNDACC (2010) shows that young people aged 14–25 spend around 3 h watching TV and 1 h and 20 min on the Internet.

In relation to the factors that determine young people's screen media consumption time, the role of peers has not been studied. However, in the field of cultural consumption, peer research has focused principally on two topics.[1] Firstly, several

[1] Peer effects on an individual's behavior have been analyzed in several other fields, including educational achievement, health status and habits as well as criminal activity. In the case of education, since Coleman et al's. (1966) analysis, most studies have identified the effect of school peers on student performance, showing that 'good peers' in educational terms increase academic achievement at primary education (see Hoxby (2000) and Hanushek et al. (2003) for the United States), at secondary education (Dills (2005) in the United States, Zimmer and Toma (2000) for the United States and other five developed countries, and Kang (2007) in South Korea) as well as at University level (Sacerdote (2001) and Zimmerman (2003) for the United States). Moreover, Maani and Kalb (2007) point out that those whose peers have better marks have a lower probability to drop out at secondary education in New Zealand, and Duarte et al. (2011) show that if school peers have a higher rate of skipping classes, the probability of school truancy increases. However, there are also a few exceptions (Angrist and Lang 2004; Lefgren 2004; Arcidiacono and Nicholson 2005) that suggest that peer effects are very small or nonexistent. In relation to health, several authors have reported that friends or classmates have a significant impact on health-related behaviors in the young. Thus, smoking and drinking are increased if peers are also cigarette and alcohol consumers—see Norton et al. (1998) and Halliday and Kwak (2012) for the United States as well as Kiuru et al. (2010) for Finland (in this case there are positive effects on drinking but not on smoking). Likewise, Gaviria and Raphael (2001) and Clark and Loheac (2007) in the United States and Lundborg (2006) in Finland also find peer effects in alcohol and tobacco consumption as well as in drug consumption. Moreover, peer effects in alcohol consumption are also reported by Duarte et al. (2011) in Spain. Interestingly, Harris and González (2008) find asymmetric peer influence: The pro-smoking influence of one fellow smoker markedly exceeds the deterrent effect of a nonsmoking peer. Finally, Cohen-Cole and Fletcher (2008) and Halliday and Kwak (2009) show that the body mass index (BMI) is influenced by the BMI of peers. In addition, some authors discuss peer effects in relation to criminal activity. Thus, the behavior of neighborhood peers appears to substantially affect youth behavior (Case and Katz 1991), especially for females

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qualitative studies have described how peer opinions can influence youth consumption. Thus, in a study focused on the computer gaming of 7–14-year-old German children, Fromme (2003) found that, for boys as well as for girls, friends were the most important advisers and mediators in game-related matters through the verbal channel (children are told there is a new game) and because they see and try a new game at a friend's home. Similarly, Tabernero et al. (2010) reported that not only video game but also Internet use among Spanish adolescents (12–18-year-olds) was largely influenced by their classmates (the latter due to the fact that part of the Internet consumption is related to communication and social relationship with friends). Research conducted in several countries has also reported that youngsters discuss the media with their peers (Youniss and Haynie 1992; Suess et al. 1998; Nathanson 2001). In Canada, Willoughby (2008) concludes that closer relationships with friends (measured by the level of attachment) increase Internet and computer game consumption by adolescent boys and girls in high schools.

Secondly, another line of research has considered how the media affect processes of youth socialization and the development of peer relationships (Sun and Lull 1986; Arnett 1995; Suoninen 2001; Wilska 2003; Castro 2004; Feixa 2005; Hertzberg et al. 2007; Aranda et al. 2010). These authors point out that media help young people to build and strengthen relationships with their peers. As indicated by Aranda et al. (2010), by using Internet and video games (especially the former), young people generate opportunities for support, sociability and recognition, which are also informal learning spaces supported by their daily social circle. Likewise, they share experiences, concerns and opinions. Moreover, the use of screen media may have both positive and negative effects on the cognitive, educational and social development and health habits of young people, all of which can affect their school achievement and subsequent life paths. Although evidence of the net effects (positive and negative) is still unclear, 'abusive' use of screen media seems to have a negative impact (see Roe and Muijs 1995, 1997, 1998; Hancox et al. 2005; Chou and Tsai 2007; Lee 2008; Schmidt and Vandewater 2008; Willoughby 2008; Munasib and Bhattacharya 2010; Louw and Winter 2011; Padilla-Walker and Coyne 2011).[2] Likewise, adolescence is recognized as being a critical developmental period in which young people are exposed to many new situations, establish their personal identity and become increasingly reliant on friendship groups (Irwin et al. 2002). As such, during these years, social interactions with friends, classmates, neighbors, etc., can be at their most intense and have a decisive effect on adolescent behaviors.

Further than peer effects, many surveys and studies provide evidence that some factors have a bearing on media use, including gender, age and the socioeconomic status of the family.

Footnote 1 continued
(Kling et al. 2005). In addition, Glaeser et al. (1995) point out that peer effects are highest in petty crimes (such as larceny and auto theft), moderate in more serious crimes (assault, burglary and robbery) and almost negligible in murder and rape. Finally, Bayer et al. (2009) show that more contact (in the same correctional facility) with juvenile offenders increases criminal behavior.

[2] The American Academy of Pediatrics (2001) classifies 'low' viewers as those who consume a maximum of 2 h of TV per day, and 'high' viewers as those who spend 4 or more hours.

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Gender is an important factor in terms of both the quantity and the content of the media consumed. In the case of the former (content lies outside the scope of our current research), in their review of 84 studies published in the English language (since 1997), in Europe, USA, Canada and Asia, Marshall et al. (2006) conclude that boys spend more time playing video games than girls. Moreover, boys are more likely than girls to be high users (at least 4 h per day) of TV and video games. Specific studies, focused on a single country or on a set of countries, also show that boys tend to watch more television than girls—see Roe (2000) and Samdal et al. (2006) for several European countries as well as Bercedo et al. (2005) for Spain. Moreover, it is pointed out that boys spend more time playing video games—see Roe (2000) and Suoninen (2001) for Europe, Fromme (2003) for Germany, Vandewater et al. (2004) for the United States, Colwell and Kato (2005) for the United Kingdom and Japan, Chou and Tsai (2007) for Taiwan, Willoughby (2008) for Canada and Aranda et al. (2010) and Tabernero et al. (2010) for Spain. Results are especially relevant in Taiwan and Spain. In the former, males play video games 4.7 h per week, whereas females consume 2.9 h; in the latter, these figures are 5.9 for boys and 2.8 for girls. As for the Internet, some studies indicate that boys also use it more than girls (Livingstone et al. 2005 for the United Kingdom; Giles and Price 2008 for Australia; Tabernero et al. 2010 for Spain). However, in Hong Kong, Ho and Lee (2001) report that girls spend more time surfing the Internet than boys, whereas Bercedo et al. (2005) and Willoughby (2008) find no differences in frequency of Internet use by gender among Spanish and Canadian adolescents, respectively.

Age is another important factor. As Devís-Devís et al. (2009) showed for Spain, among adolescents (12–16-year-olds) the use of video games and computers increases with age. Thus, older adolescents (14–16-years-old) are more likely to use computer and video game than younger adolescents. Tabernero et al. (2010) reach the same conclusion in the case of teenagers aged 12–18-years-old (with an average of 6.3 h per week playing video games among those with 16–18-years-old and 4.4 h among those aged 12–15-years-old). In the USA, Vandewater et al. (2004) also report that computer time consumption is greater (more than double) among older children (9–12-year-olds) than among younger ones (6–8-year-olds), while the differences are much smaller for electronic game use and irrelevant for TV. A similar result is found by Livingstone et al. (2005) in the use of the Internet among teenagers (12–19-year-olds) in the UK. From a variety of samples across 28 countries, Marshall et al. (2006), who consider young consumers up to the age of 18, report a peak in TV consumption in those aged 9–12, suggesting that the relationship between age and TV viewing is curvilinear during childhood. However, the age-related differences are not statistically significant. Thus, it seems that age is relevant in the case of the consumption of the Internet (or computers in general) and video games. Moreover, longitudinal studies provide evidence for considerable stability in the viewing habits of young people, since high users of screen media at young ages (for any device) are likely to remain high users as they become older (see a review in Marshall et al. 2006).

Studies in Europe and the USA have also identified socioeconomic status (defined by parents' occupation or education) as a significant factor with regard to

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adolescents' media use (see a review in Roe 2000). Thus, reports that consider parents' occupation suggest that class cultural patterns are reproduced across generations in Europe (the countries considered are Germany, Great Britain, Norway, Sweden and the Netherlands). As Livingstone et al. (2005) showed for the UK, middle-class children are higher Internet consumers than are working-class youngsters (especially whether visiting civic Web sites is considered). As for education, Roe (2000) for TV consumption in Belgium and Willoughby (2008) for video games in Canada show that the higher the educational level of the mother (or parents depending on the analysis), the less time children tend to spend consuming electronic media. However, the educational background and cultural capital (defined by a dichotomous variable, such as having more than 100 books at home) of the parents are positively related to Internet use among German adolescents (Iske et al. 2008).

School variables have also been considered. A recent study by Devís-Devís et al. (2009) examining the amount of time spent on the use of screen media (TV viewing, computer/videogames and mobile use), in a sample of 12–16-year-old adolescents in the Valencia Community (Spain), shows that the type of school was associated with the consumption of the three media types. More specifically, students in state/public schools spend more time on screen media than do their private school counterparts. It also shows a positive association among type of school and household access to technology, which reveals that students from private schools have a higher access to technology at home than adolescents attending state schools.

3 Data and econometric strategy

In this section we describe the main characteristics of our sample and the econometric strategy used in conducting the empirical analysis (including the process used to construct the peer variable).

Data are drawn from a single representative survey of secondary school students in Catalonia (a Spanish region that accounts for 15.95 % of the country's total population), collected between February and June 2008. The survey was conducted among secondary school students in two specific academic years: the last 2 years of compulsory secondary education, known as *ESO* (students aged between 14 and 16). The questionnaires were completed by students, and teachers were approached to participate in the survey and help with student data collection. The questionnaire was supplied online, with questions presented randomly, although those schools without computer room facilities or time restrictions received the questionnaire in paper format. None of the students had access to the questionnaire prior to responding, thus avoiding risks of attrition. Students were free not to respond to all questions. The final sample contains information from 2,289 students at a total of 90 high schools.

As for our econometric strategy, here the dependent variables (time consumption of TV, console games and Internet) are truncated on the left-hand side, since some pupils do not spend any time with the items considered (in our sample, 10 % for TV and Internet use as well as 22 % for console game consumption). Thus, a Tobit

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regression is required. This model assumes that the observed censored dependent variable y takes the following values, with y^* as the latent value of response variable (see Eqs. 1 and 2):

$$y = \left\{ \begin{array}{lll} 0 & \text{if} & y^* \leq 0 \\ y^* & \text{if} & y^* > 0 \end{array} \right\} \tag{1}$$

$$y^*_{\text{ijcs}} = \beta' x_{\text{ics}} + \gamma' y_{\text{jcs}} + \varepsilon_i \tag{2}$$

Thus, the dependent variable is the time devoted to the consumption of each screen media by pupil i within peer group j in class c and in school s; y_{jcs} is our variable of interest (the average screen media consumption time of peers within the classroom); x_{ics} represents the individual set of covariates considered; and ε_i is the individual-specific error term. As individual controls, we use the following list of covariates (x_{ics}): adolescent characteristics (age, gender, immigrant status, grade obtained in mathematics in last academic year); family characteristics, such as family type (parental civil status), possession of books (a dichotomous variable that indicates the possession of 100 or more books at home, which is frequently used in socioeconomic studies, such as the PISA evaluations of the OECD), Internet access, number of siblings and of older siblings, difference in years between the mother and the adolescent, mother's education and health status, whether parents do not allow students to go out often or very often, whether nobody helps pupils with their homework and school type (public and private or private publicly funded).

In accordance with the thesis of Heckman et al. (2006), who propose that (latent) noncognitive skills and cognitive skills are equally important factors in determining an individual's behavior, our econometric specification includes a measure of individual 'conscientiousness.' Although other measures may be affected by peers, personality traits are specific to each individual and are not so likely to be influenced. Thus, we are able to include this covariate as a proxy for student fixed effects, and as such, it constitutes a different source of ability.

The conscientiousness variable was constructed through factor analysis from the information given by pupils through the questionnaire. We conducted several interviews with psychologists in order to ensure that relevant questions were included regarding conscientiousness. They recommended us to include the questions from the well-known Big Five Personality Trades Test (see Norman 1963). Specifically, we incorporated the following issues: I am exacting in my work; I follow a schedule; I get chores done right away; I pay attention to details; I leave my belongings around; I make a mess of things; and I shirk my duties. We computed Cronbach's alpha statistics for the scale formed from the pairs of variables (0.76). The Kaiser–Meyer–Olkin measure of sampling adequacy (0.81) was satisfactory to proceed with factor analysis. Accordingly, the factor scores were rescaled to a new variable ranging from 0 to 1, indicating the degree of personal conscientiousness (1 is related to a high degree of conscientiousness in relation to school work).

Once the basic regression model has been explained, it has to be pointed out that in order to construct the peer variable, certain aspects have to be taken into consideration. Any analysis of peer effects suffers from what is known as the

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'reflection problem' (Manski 1993), which influences the identification of endogenous social effects. In accordance with these influences, individual and peer behavior may be correlated for three different reasons: (1) the direct influence of peer behavior on individual behavior ('endogenous' effect or reverse causality); (2) the indirect influence on individual behavior attributable to the exogenous characteristics of the peer group ('exogenous' or 'contextual' effect); and (3) the influence of a common set of unobservable variables on both individual and peer behavior ('correlated' effect). The first two effects reflect social interactions, whereas correlated effects are a statistical, nonsocial phenomenon (Manski 1993, 2000). Given the plausibility of this hypothesis, the main empirical challenge faced by observational data in the literature is to discriminate between or disentangle these three effects and to identify a causal relationship of peer influence on adolescent behavior.

Our data allow all aforementioned problems to be solved. In the case of 'exogenous' or 'contextual' influences, we include controls denoting average peer characteristics as regards lifestyle behavior, such as physical activity (taking part in sporting activities) and obtaining parental permission to go out. In the case of 'correlated' effects, we consider average characteristics at the classroom level (including average age and the percentage of pupils with a mother with higher education). These variables allow us to resolve another problem when analyzing peer effects: the fact that schools, classrooms and peer groups are not formed randomly (sorting effect). Moreover, the introduction of these variables as opposed to a dummy variable for each class avoids the inefficiency associated with introducing so many fixed effects. Considering the aforementioned findings, the regression model becomes the one indicated in (3).

$$y^*_{ijcs} = \beta' x_{ics} + \gamma' y_{jcs} + \delta' z_{jcs} + \lambda' c_{cs} + \varepsilon_i \tag{3}$$

In this model, z_{jcs} stands for the average characteristics of the pupil's network of friends, and thus, in this equation 'contextual' effects are captured by δ. Likewise, c_{cs} represents the 'correlated' effects emerging from common environmental factors, and they are addressed by using average classroom characteristics.

However, Eq. (3) is not the final model since we have to apply instrumental variable (IV) estimation to solve the 'reflection' problem. In this type of analysis, the instrument must be correlated with the independent variable but not with the dependent one. In our case, we use as instruments some characteristics of the respondents' friends-of-friends who are not friends with the respondent, in accordance with the intransitivity property of network relationships (Bramoullé et al. 2009). We were able to obtain this information because students were asked to report all friends they wanted from their classroom and not only 'mutual friends' (students nominated reciprocally). Specifically, our instruments refer to the mean attributes of the variables related to an individual's screen media consumption, such as cultural level (a dummy referred to the number of books at home as previously described), Internet access as well as the number of siblings and of older siblings. We consider the mean values of the peer group characteristics (median values were also applied with no significant changes in the results). Average peer groups consist

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of 8 individuals (mean, 7.93; standard deviation, 5.24). Thus, the final regression model is shown in (4), where y_{kcs} is the instrument mentioned earlier.

$$y^*_{ijcs} = \beta' x_{ics} + \gamma' \hat{y}_{jcs} + \delta' z_{jcs} + \lambda' c_{cs} + \varepsilon_i \tag{4}$$

$$y_{jcs} = \phi' y_{kcs} + \upsilon_{cs}$$

Finally, we wish to highlight that our peer variable presents a number of advantages over the data used in most previous studies. First, we define peer groups using nominated friends within the classroom (few other studies have been able to define peer pressure at such a precise level). Thus, our social networks are more strongly connected and less varied than those used at school level, since they are formed within the same classroom (Cohen-Cole and Fletcher 2008). Second, following Bishop et al. (2004), in our dataset students could nominate as many close classroom friends as they wished. Third, we consider as peers all classroom friends chosen by each adolescent and not only students nominated reciprocally, because students are affected not only by 'mutual friends.' As indicated, this allowed us to generate the instrument needed to overcome endogeneity.

Table 1 presents the definitions for the list of covariates as well as the main descriptors considered in our estimations. On average, pupils claim to watch TV for 2 h each day, to spend a further 2 h using the Internet and to spend more than half an hour playing with their consoles. Although not all studies consider the same age-groups and periods, we may point out that, in comparison with the reports discussed in Sect. 2, our sample presents less consumption of TV, similar patterns for console use and a slightly higher consumption of the Internet. As for our covariates, it should be stressed that 63 % of individuals have Internet access at home.

4 Results

This study provides us with information about patterns of screen media time consumption among young people. In Table 2 we report results from the Tobit regression, and subsequently, in Table 3 we present the estimates through the IV approach (described in Eq. 4). Differences in the results from both regressions show the importance of using instrumental variables estimations to control for endogeneity.

Results from the Tobit model show that classmate peers have a positive effect on a teenager's TV consumption and Internet use, whereas this variable is not statistically significant in the case of console consumption (note that OLS estimations give very similar results). Thus, an additional daily hour of TV consumption among peers increases a pupil's consumption of TV by 0.13 h (almost 8 min). In the case of Internet use, an additional daily hour of Internet use among peers increases a pupil's consumption by 0.17 h (around 10 min). Expressed in other terms, peer effects represent 7.6 % of the standard deviation of TV consumption and 9.1 % of the standard deviation of Internet use. Consequently, peer effects would seem only to have a very small effect on TV and Internet use and have no bearing whatsoever on console game consumption.

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Table 1 Sample descriptors

	Mean (SD)
Continuous time allocated to watching TV	1.99 (1.75)
Continuous time allocated to console games	0.66 (1.09)
Continuous time allocated to Internet use	1.90 (1.90)
Conscientiousness	0.60 (0.13)
Pupil's age	15.55 (0.74)
Being female	0.52 (0.50)
Immigrant pupil	0.10 (0.30)
Private and private publicly funded schools	0.53 (0.50)
Math grade last academic year	6.31 (1.59)
Internet access at home	0.93 (0.26)
Number of books at home below 100	0.40 (0.49)
Number of books at home 100 & above	0.48 (0.49)
Number of books at home missing	0.12 (0.32)
Parents not being married	0.23 (0.42)
Mother with primary education	0.12 (0.32)
Mother with secondary education	0.45 (0.49)
Mother with higher education	0.30 (0.46)
Mother's education not known	0.13 (0.34)
Difference in years with mother	28.57 (4.69)
Poor mother's health	0.14 (0.35)
Nobody helps with homework	1.10 (1.06)
Number of siblings	0.17 (0.37)
Number of older siblings	0.41 (0.49)
Parents do not allow child to go out often and very often	0.45 (0.50)
Average age at classroom level	15.55 (0.53)
Average pupils with higher educated mother at classroom level	0.30 (0.18)

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In the case of the other explanatory variables, we highlight the following results (see Table 2). Certain personal characteristics are relevant in the time consumption of screen media. Thus, those with a higher level of conscientiousness spend less time on the Internet. According to our empirical evidence (see Sect. 2), female students spend less time playing console games. In our study, girls also consume more Internet than boys (a finding contrary to that reported in most studies, but similar to Ho and Lee's (2001) result). Age and immigrant status are irrelevant. These results seem reasonable since we are using a very homogeneous sample in terms of age, and immigrants constitute just 10 % of the total sample. Finally, those who obtained higher grades in mathematics in the previous academic year were found to spend less time watching TV. In relation to family characteristics, the lower the cultural level of the parents, the higher we found the consumption of Internet to be (in contrast with Iske et al's. (2008) findings in Germany). Moreover, having Internet access at home increases Internet and console use and reduces TV

Table 2 Determinants of screen media time use. Tobit regression analysis

	TV consumption	Console consumption	Internet use
Consumption of classmates peers	0.134 (0.05)***	0.008 (0.02)	0.172 (0.05)***
Conscientiousness	0.133 (0.27)	0.047 (0.17)	−0.770 (0.32)**
Pupil's age	0.039 (0.08)	−0.039 (0.04)	0.030 (0.08)
Being female	−0.081 (0.07)	−0.417 (0.04)***	0.146 (0.08)*
Immigrant pupil	0.109 (0.16)	−0.093 (0.07)	0.051 (0.16)
Private and private publicly funded schools	0.006 (0.08)	−0.073 (0.04)*	−0.035 (0.10)
Math grade last academic year	−0.048 (0.02)*	0.004 (0.01)	−0.040 (0.03)
Internet access at home	−0.380 (0.14)***	0.235 (0.07)***	2.966 (0.24)***
Number of books at home below 100	0.163 (0.09)*	−0.003 (0.04)	0.202 (0.08)**
Parents not being married	−0.001 (0.09)	0.062 (0.05)	0.141 (0.11)
Primary educated mother	0.120 (0.11)	0.045 (0.07)	0.162 (0.15)
Higher educated mother	−0.089 (0.08)	−0.024 (0.05)	0.013 (0.10)
Difference in years with mother	−0.011 (0.01)	0.001 (0.00)	−0.015 (0.01)*
Poor mother's health	−0.129 (0.11)	0.050 (0.05)	0.166 (0.12)
Nobody helps with homework	−0.047 (0.07)	−0.040 (0.04)	0.073 (0.08)
Number of siblings	−0.145 (0.05)***	−0.006 (0.03)	−0.172 (0.06)***
Number of older siblings	0.315 (0.13)**	−0.015 (0.07)	0.265 (0.14)*
Parents do not allow child to go out often	−0.049 (0.07)	0.015 (0.04)	−0.136 (0.08)*
Constant term	3.929 (1.10)***	2.475 (0.59)***	1.420 (1.40)
Average covariates at classroom level	Yes	Yes	Yes
Correlated effects	Yes	Yes	Yes
N	2,289	2,289	2,289
F-stat	2.97 (0.00)	64.69 (0.00)	14.24 (0.00)
Pseudo R^2	0.0807	0.2782	0.1191

Clustered standard errors were computed and reported in brackets. ***, ** and * denote statistical significance at 1, 5 and 10 %, respectively. All regressions include dummy variables representing outliers

Table 3 Determinants of screen media time use. Instrumental variables approach

	TV consumption	Console consumption	Internet use
Consumption of classmates peers	0.074 (0.11)	0.086 (0.04)**	0.642 (0.21)***
Control variables	Yes	Yes	Yes
Average covariates at classroom level	Yes	Yes	Yes
Correlated effects	Yes	Yes	Yes
N	2,186	2,186	2,186
F-stat	23.63 (0.00)	180.48 (0.00)	37.73 (0.00)
Cragg-Donald Wald *F*-statistic	80.11 (0.00)	66.51 (0.00)	26.20 (0.00)
Sargan overidentification test	0.11 (0.99)	4.07 (0.25)	2.45 (0.29)

Clustered standard errors were computed and reported in brackets. ***, ** and * denote statistical significance at 1, 5 and 10 %, respectively, in Stata. All regressions include dummy variables representing outliers

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consumption. Finally, having older siblings increases the number of hours spent consuming TV and the Internet. All other variables are not statistically significant or only so at the 10 % level.

In relation to the variables included in the model, it has to be pointed out that some were dropped after having checked their statistical significance in order to avoid inefficiency in our estimates. In addition, we also analyzed by means of a SURE estimation procedure, that is, estimating jointly the three equations shown in Table 2. Results hardly change (they are available upon request).

As indicated before, the results shown are from a Tobit regression analysis. However, as discussed in the previous section, our empirical analysis should also take into consideration the endogeneity problem. To this end, we estimated the equation using instrumental variables. Our results in Table 3 show that peer effects are positive and statistically significant for console and Internet consumption. In the case of the former, an additional daily hour of console game consumption among peers increases an individual's consumption by 5 min (representing 7.9 % of the standard deviation). In the case of the latter, an additional daily hour of Internet use among peers increases a pupil's consumption by 37.5 min (representing 33.8 % of the standard deviation). Thus, the IV results show that there are no peer effects in the case of watching TV; the effects are small for console game use but quite significant for Internet consumption. The statistics from the IV model show the validity of the instruments used (see the Cragg-Donald Wald statistics in the Table) and that there is no overidentification of the model.

Finally, we chose to expand the analysis so as to determine whether there are any differences in peer effects by gender. Results obtained from IV estimation by gender are shown in Table 4. As it is shown, in the case of Internet use, peer effects are statistically significant for boys and girls, being higher for the former than for the latter. Thus, one more hour of Internet use by a peer increases the consumption of boys by 51.5 min and that of girls by 35.6 min. As for console consumption, the peer effect reported above is only statistically significant for boys (a one-hour increase in use by a peer raises male consumption by 7.3 min). Finally, as expected, there is no peer effect on the TV consumption of either gender.

5 Conclusions

We have analyzed the effects of peers on individual screen media consumption. Specifically, we have considered the time dedicated to using the TV, console games and the Internet. We have been particularly careful in our construction of the peer variable and in conducting the estimation procedure given the 'reflection problem.' As regards the former, we have defined peer groups in terms of friends nominated within the classroom (not at school level), with pupils being allowed to nominate as many classroom friends as they wished. As regards the latter, we have implemented instrumental variable regressions (with instruments being created with information about the characteristics of the respondents' friends-of-friends who were not friends of the respondent) and have included variables that allow us to control for all the problems related to endogeneity indicated by Manski (1993).

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Table 4 Determinants of screen media time use by gender. Instrumental variables approach

	TV consumption		Console consumption		Internet use	
	Male	Female	Male	Female	Male	Female
Consumption of nominated peers	0.065 (0.15)	0.121 (0.16)	0.122 (0.05)**	0.028 (0.05)	0.859 (0.35)**	0.594 (0.23)***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Average covariates at classroom level	Yes	Yes	Yes	Yes	Yes	Yes
Correlated effects	Yes	Yes	Yes	Yes	Yes	Yes
N	1,026	1,160	1,026	1,160	1,026	1,160
F-stat	14.00 (0.00)	13.38 (0.00)	94.44 (0.00)	103.86 (0.00)	19.31 (0.00)	23.13 (0.00)
Cragg-Donald Wald *F*-stat	42.03 (0.00)	38.95 (0.00)	32.96 (0.00)	33.51 (0.00)	9.34 (0.00)	24.25 (0.00)
Sargan overidentification test	1.25 (0.74)	1.46 (0.69)	5.61 (0.13)	5.42 (0.14)	4.10 (0.13)	0.74 (0.69)

Clustered standard errors were computed and reported in brackets. ***, ** and * denote statistical significance at 1, 5 and 10 %, respectively, in Stata. All regressions include dummy variables representing outliers in answer to these questions

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A clear set of findings emerges from our study. Peer effects are positive and statistically significant for console game use and Internet consumption. This effect is quite modest in the case of consoles but quite large in that of the Internet. Thus, a 1-h increase in console game consumption raises an individual's consumption by 5 min, whereas one more hour of peer use of the Internet increases a pupil's consumption by 37.5 min. IV estimation shows no peer effect on watching TV.

Moreover, when differences in consumption by gender are considered, our results indicate that peer effects are statistically significant only for boys in the case of console game use and that there are differences in the magnitude of peer effects on Internet consumption: One more hour of peer Internet use increases boys' consumption by 51.5 min and that of girls by 35.6 min.

The peer effect enables us to conclude that there is a multiplier effect in the case of the consumption of certain screen media (the Internet and video consoles), given that the consumption of one individual can increase the consumption of those with whom he of she is a peer.

Our results do not examine the reasons behind the positive peer effects on Internet and game console consumption. However, some comments may be added. Thus, it seems that game console use may be positively affected by peer's consumption for several reasons, the existence of multiplayer games and competitiveness within the peer group, as well as that young players meet at peers' houses to play. In relation to Internet use, some of the time devoted to Internet is spent on social networks, where peers have an important role. In any case, future qualitative analysis may provide some answers to the causes of the reported peer effects.

Moreover, other issues should be related to further research. On the one hand, future studies should consider increasing the sample size (although we believe that the one used was quite large). On the other hand, it would be of some interest to analyze the determinants of the screen media contents consumed by teenagers (not solely the time consumed) and to expand our study to consider other modes of consumption (not solely TV, the Internet and video games but also social networks, mobile phones and similar devices).

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