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Abstract

Lo scopo del presente elaborato è di presentare il modello della *rational addiction* sviluppato da Gary S. Becker e Kevin M. Murphy, in opposizione a quelle che erano le teorie precedentemente accettate da un lato, alla luce delle successive rielaborazioni dall'altro, in particolare per quanto riguarda le sue applicazioni empiriche e il problema delle *time-inconsistent preferences*.

L'elaborato procede esponendo le caratteristiche ed implicazioni del modello per poi riportare i risultati dei numerosi studi empirici che, nel corso dei decenni successivi, hanno avvalorato o talvolta indebolito le conclusioni raggiunte da Becker e Murphy.

Nella seconda parte dell'elaborato si presentano i dati del rapporto dello European School Survey Project on Alcohol and other Drugs (ESPAD) del 2007 e si riportano alcune correlazioni individuate che, lungi dal voler avvalorare o smentire le implicazioni del modello, possono mostrare affinità con esso.

Index

I. Introduction

The rational addiction model finds its roots in the paper *De gustibus not est disputandum* by George J. Stigler and Gary S. Becker, published in the American Economic Review in 1977. Although the expression *rational addiction* is never used in it, being its main topic the stability of tastes over time, the paper draws a new and revolutionary approach to behaviours such as habits, fashions and addictions, which had long been considered inconsistent with the rational choice model. What Stigler and Becker claim instead, is that such behaviours can be explained within the rational utility-maximizing framework and that it is neither necessary nor useful to develop a separate theory.

This new approach was then developed in a path-breaking article by Becker and Kevin M. Murphy: *A theory of rational addiction*, published in the Journal of Political Economy in 1988.

Before the introduction of this model, other studies by Pollak (1970,1976) had analysed habits and addictions regarding them as *non-rational* and therefore using a *myopic* model of consumption to explain them. Pollak, in particular, stressed the necessity to introduce a distinction between short-run and long-run demand functions, pointing out that, among other reasons (the consumer might have contractually fixed commitments or he might be ignorant of some consumption possibilities), some goods could be considered *habit forming*, in a way to make individual's current preferences dependant on the past consumption patterns. The main implication of Pollak theory is that *ceteris paribus,* a higher level of past consumption of a *habit forming* good results in a higher level of current consumption.

What later studies by Ryder and Heal (1973), Boyer (1978), and Spinnewyn (1979) showed however, was that Pollak theory, although successful in recognizing the complementarity of choices among time, did not take into account that in the same way past consumption affects current consumption, future consumption and future prices may have an influence on current choices too. This is the reason why models such as Pollak's one are called *myopic*, meaning that they are based on the assumption that individuals ignore the future when making their decisions. It needs to be stressed that the myopic models do not fail to take into account the future simply *by mistake*, on the contrary, they are based on the very notion that consumers are *naive* and not aware of the *habit-forming* effect of current consumption, or that they simply ignore it.

In the Becker-Murphy model the term *rationality* implies a consistent plan to maximize utility over time as individuals anticipate the future consequences of their choices. Therefore,

addictions, even strong ones, are not regarded as something irrational: they are the result of a forward-looking maximization with stable preferences. In other words, individuals do recognize the addictive nature of the choices they make, but they still make them because the total gain form the activity exceeds the total costs of it.

The rational addiction model has gradually became the standard approach to the consumption of addictive goods. Its rapid acceptance is due in part to its theoretical rigour, and in part to its empirical success since, although we do not have empirical evidence that supports the hypothesis of full rationality, its key theoretical predictions have generally been confirmed empirically

This dissertation proceeds as follows. In part II, we report the rational addiction model proposed by Becker and Murphy along with its implications. In part III we summarize and discuss some of the main objection to the model on the theoretical ground. In part IV we report a number of empirical studies aimed to test the model on panel data. In part V we deal with time-inconsistent preferences and their problematic implication with the rational addiction model. In part VI we report the data of the European School Survey Project on Alcohol and other Drugs (ESPAD) along with some patterns we found.

II.The rational addiction framework

Before examining the model, it is important to understand that the present notion of addiction does not have any negative connotation and includes harmful activities as well as beneficial ones. This notion of addiction is therefore extremely wide and ranges from the consumption of alcohol, cigarettes, cocaine, heroin, caffeine, to activities such as work, food, TV, sex, shopping, religion, jogging, standards of living, that can actually display the same characteristics.

Habits and Addictions

The usual assumption in most discussions on behaviours over time is that current choices do not directly depend on choices made in the past. Such an assumption, although it usually simplifies many problems that are not crucially affected by dependencies over time, cannot hold in dealing with the present issue. The reason is that habits are defined *precisely* as behaviours that display a positive relationship between past and current consumption. This means that in habitual behaviours past and present consumption are complementary goods, which implies a negative cross elasticity of demand.

Habits are regarded as beneficial when greater current consumption raises future utility (as for swimming or jogging) and as harmful when greater present consumption lowers future utility (as for heavy drinking, smoking, and overeating).

An addiction is defined as a *strong* habit that displays *adjacent complementarity*.

We say we have adjacent complementarity when the current consumption of a good **c** increases the marginal utility of its future consumption. Adjacent complementarity is indeed a necessary condition for addiction, but it is by no means a sufficient condition even for potential addiction. Other parameters must be taken into account, such as the discount rate on future utility and the rate of decay or depreciation in the contribution of past consumption to present consumption.

It is interesting to notice that a habit might be raised into an addiction by the exposure to the habit itself. This is likely to happen with such habits as alcohol consumption, which are amenable either to reduce the negative value that an individual attaches to the future consequences of overconsumption, either to increase his discount rate on the future.

In addition, it should not be overlooked that people often become addicted simply because some events turn out differently from what they had expected, affecting the value that they attach to their future utility in general.

It is also true that for harmful addictions the absence of any immediate negative effect from past consumption (or the rather quick decay of them) can easily incentive current consumption. As an example, an excessive consumption of alcohol is very likely to lead to physical and mental effects that any drinker will difficultly forget; on the other hand, excessive consumption of cigarettes usually does not bring any particular immediate negative effect on a smoker that might induce him to reduce is cigarette consumption.

We can quite safely state that, other things equals, people who discount the future heavily are less likely to be deterred from harmful addictions that reduce their future utility and that they would also be less attracted by beneficial addictions that raise it. Of course, the opposite is true for people with low discount rates on the future.

It is no surprise then, that harmful addictions are not seldom associated with other dangerous activities. The explanation is very straightforward: people who fall into harmful addictions usually have higher discount rates on the future, so they are more likely to indulge also in other dangerous behaviours.

Poor and young people show to be more present-oriented, whereas highly educated people usually have lower rates of preference for the present, which is perfectly consistent with their choice to study and wait for the delayed benefits of higher education.

Although it would be reasonable to expect old people to be more impatient since – to be brutal - they do not have much time ahead of them, all data show that the elderly seem to give more important to the future than any other age group. However, such a result should be treated with caution since it could simply be that people who manage to get old are precisely those who are less present-oriented.

What it is important to understand anyway, is that addictions are not an universal endogenous property of certain substances or activities, nor a idiosyncratic, or worse, a genetic feature of some people: all addictions do necessarily involve an interaction between the individual and the good. As a result, the same good is not addictive to everyone indistinctively and the same person may be addicted to some goods but not to others.

All the studies on addictions have usually found two important features: *reinforcement* and *tolerance*.

Reinforcement implies that greater past consumption of an addictive good increases the desire for present consumption. Tolerance, on the other hand, cautions that the greater consumption has been in the past, the lower the utility from a given amount of consumption is in the present. This does not only imply that current consumption is encouraged by greater past consumption, but also that a larger level of current consumption is needed to reach the standard of utility set by past consumption. We call these kind of comparisons between past and present *invidious comparisons* and they actually are something everyone is exposed to in his daily experience: it is very easy to observe that it is not poor health itself that makes elderly people depressed but the decline in health, or that *nouveu* riches tend to be happier than the long-term riches and, conversely, the new poors are more miserable than the long-term poors.

So essentially, if utility depends on comparisons between present and past consumption, it would be highest just after consumption rose to a permanently higher level, and it would then decline over time as the person became accustomed to that level.

Becker and Murphy's Rational Addiction Model (1988)

The Becker and Murphy model implies the formulation of a new type of utility function that includes the effect of past consumption on current consumption.

Assuming that the utility of an individual depends on the consumption of two goods, *c* and *y*; being *c* the addictive good, the utility function we have is:

$$u(t) = u[y(t), c(t), S(t)]$$

We assume *u* to be a strictly concave function of *y*, *c* and *S*.

S indicates the way past consumption of *c* affects current utility in a process of *learning by doing*, and it is called *consumption capital*.

The rate of change of the stock of consumption capital over time can be written as:

$$S = c(t) - \delta S(t) - h[D(t)]$$

Where **δ** is the instantaneous depreciation rate that measures the exogenous rate of disappearance of the physical and mental effects of past consumption of *c* , and **D(t)** represents the expenditures on endogenous depreciation or appreciation.

Tolerance can be written as $u_s = \partial u / \partial S < 0$, which shows how greater past consumption lowers current utility, or differently stated, how higher *c(t)* lowers future utility.

Reinforcement can be written as $dc/dS > 0$ and requires that an increase in past use raises the marginal utility of current consumption: $u_{cs} = \partial^2 u / \partial c \partial S > 0$.

Becker and Murphy then show that rational addictions require that the positive effect (u_{cs}) of an increase in *S(t)* on the marginal utility of *c(t)* exceeds the negative effect (u_{ss}) of higher *S(t)* on the future harm from greater *c(t)*. It is not surprising then that the addiction is more likely for people who discount future more heavily and when the effects of past consumption depreciate more rapidly.

With a length of life equal to *T* and a constant rate of time preference *σ*, the utility function would be

$$U(0) = \int_0^T e^{-\sigma t} u[y(t), c(t), S(t)] \, dt$$

A rational individual maximizes his utility subject to a constraint on his expenditures that is given by the initial value of his assets (A_0) and his earnings (*w*). The optimal solution gives the maximum obtainable utility given the initial assets, the initial stock of consumption capital, the earnings and the prices.

The full price or shadow price of an addictive good ($\Pi_c(t)$) of *c(t)* equals the sum of its market price and the monetary value of the future costs and benefits of consumption. For example, in the case of heroin future health damages and the risk of conviction for possession of illegal substances should be included among the costs, while in the case of jogging better health in the future and the possibility of socializing with new people should be included among the benefits.

8

The Effect of Price on the Consumption of Addictive Goods

According to conventional wisdom the consumption of addictive substances (such as heroin or cocaine, but also alcohol and nicotine) is not very responsive to price. However, the empirical evidence from the 1970s on does not support such a view, which is also contradicted by Becker and Murphy theoretical model.

As shown in the Becker and Murphy model, an important implication of reinforcement is that consumptions of an addictive good at different times are complements, therefore a price change either in the past or in the future prices should affect current consumption. An increase in future prices, for example, would decrease current consumption since individuals in order to maximize their utility in the long-term would be willing to lower the future cost of their addiction.

An important insight of the analysis of the effects of price changes on addictive goods consumption is that the long-run responses exceed short-run responses. The reason is that in the short run the stock of consumption capital is fixed, while in the long run it increases/decreases in a way that stimulates further growth or decrease in consumption.

It follows then that temporary changes in prices of addictive goods have smaller effects on consumption than permanent changes. The reason is that complementarity between present and future consumption is less relevant with temporary price changes since future prices do not change. This is indeed an important insight for lawmakers and legislators willing to tackle addictions, since it implies that the only way to effectively reduce consumption in the long run is to permanently raise the full price of addiction either through taxation (with legal substances) either with more effective law enforcement (with illegal ones). Temporary *wars on drugs* or *zero tolerance* policies will never significantly affect the consumption of any drug, since people perfectly anticipate that the commitment is only temporary.

Since the total cost of addictive goods to consumers equals the sum of the good's price and the money value of the future adverse effects (poor health, risk of criminal punishment) it is plausible that as price becomes a bigger share of the total cost, long-run changes in demand induced by a given percentage change in the money price get larger relative to the long-run changes induced by an equal percentage change in future costs.

It has also been observed then that the money price tends to be relatively more important to poorer and younger consumers, partly because they both generally place a smaller value on health and other future harmful effects, partly because they also appear to discount the future more heavily.

In addition, it is important to stress that changes in the addiction cost may not derive only from changes in the monetary price of the good, but also from exogenous events that can increase or decrease the total cost of it. Ippolito, Murphy, and Sant estimate that eleven years after the first Surgeon General's report on smoking in 1964, per capita consumption of cigarettes had been reduced by 34%. Divorce, unemployment, death of a loved one are all examples of events that may affect either the value that an individual attaches on his future utility, either his discount rate on the future, inducing larger consumption of harmful addictive goods. On the other hand, events such as marriage, a new job, the birth of a child have an opposite effect on harmful addictions and can induce a larger consumption of beneficial addictive goods.

We can well understand now why people with the same utility function and the same wealth who face the same prices may have different degrees of addiction if they go through different experiences.

Cold Turkey

The expression *cold turkey* (whose ethology is still a matter of discussion) indicates the abrupt cessation of an addiction and the resulting unpleasant experience, as opposed to a gradual reduction of consumption over time. This behaviour could look totally inconsistent with rationality, but actually it is not only consistent with it, but even necessary.

A rational individual may decide to end his addiction if some events lowers either his demand for the addictive good, either the stock of consumption capital.

Since we know that the higher the degree of complementarity and the degree of addiction, the larger the effect of current consumption on future consumption, rational individuals will end stronger addiction more rapidly than weaker ones. Cold turkey is then by no means inconsistent with rational addiction, on the contrary, Becker and Murphy model actually requires strong addictions to terminate precisely with cold turkey.

The model does not underestimate the considerable level of pain related to cold turkey, it simply states that such a short-run loss in utility is more than compensated by a larger long-run gain. There is no need then to call for explanations such as *weak will* or *limited self-control* to understand why some addictions can only end abruptly: an individual will terminate his addiction if and only if the discounted value of the long-run gain is larger than the value of the short-run loss.

The extended, ultimate meaning of this is that a person will make certain changes in his behaviour only when he finds a way to raise the long-run benefits sufficiently above the short-run costs of adjustment. Under this point of view, the claim of some heavy drinkers or heavy

smokers that they want to but cannot end their addiction is not different from the claim of disorganized persons that they want to but they cannot become better organized or from the claim of single people that they want but are unable to get married. As soon as the value of this people's long-run utility exceeds the cost of adjustment they will not be smokers, alcoholic, disorganized or single any longer.

Cyclical Consumption Patterns and Rational Addiction

As noticed by Becker and Murphy some addictions (such as alcohol and eating) display cycles of consumption in which *binges* alternate with period of lower consumption or abstention. As in the case of cold turkey, such a behaviour may seem the prototype of irrationality, but it has actually been proved to be totally consistent with the rational choice theory by Becker and Murphy, as well as Englebert J. Dockner and Gustav Feichtinger (1993). More precisely, Dockner and Feichtinger take what in Becker and Murphy's work is not much more than a small extension of the model and develop it in a much more complete analysis of cyclical consumption of addictive goods.

The main premise to this extension is the assumption that in order to have cyclical consumption, an addictive good must accumulate at least two different stocks of consumption capital with different depreciation rates. The interaction of these two stocks are the cause of the irregular behaviour. In particular, current consumption must be positively related with one of the two stocks and negatively related to the other stock, implying that consumption cycles require two counterbalancing effects: an addictive one and a satiating one.

The best example is arguably overeating, in which case the two stocks are called *eating capital* and *weight.* The addictive forces (*eating capital*) causes current consumption to increase as past consumption accumulates (the ascending part of the cycle), while the satiating forces (*weight*) causes current consumption to decline as habits accumulate (the descending part of the cycle). The higher depreciation rate of the addictive stock then generates periods with increasing as well as decreasing consumption.

An interesting insight of this model is that it allows us to make a distinction between full addicts and partial addicts. We say that someone is fully addicted if both stocks of capital are positively related to consumption, in which case, the individual's behaviour will display a monotonic consumption profile. On the other hand, we say that someone is partially addicted if one stock is positively related to consumption and the other is negatively related, in which case the individual's behaviour is very likely to result in consumption cycles.

III. Theoretical Opposition to rational addiction

This section tries to expose some of the most common and important theoretical oppositions to the rational addiction theory, leaving to the next ones any objection made on the basis of empirical tests. Such critiques are not easy to summarize since they are usually found as a part of a more vast and extended framework in opposition to the whole body of Becker's work and to the fundamentals of his rational choice approach. Some of them are very easily rejected, some need to be discussed and finally some effectively manage to point out some weaknesses in the model.

A rather common argument is that if people were really rational, they would succeed in their plans more often than it actually happens in real life. This is a very cheap objection which denotes a complete misunderstanding of the term *rational*. Rationality does not imply the achievement of one's aim, it only means that one has no reason to think that he should have acted differently, given what he knew and could have known at the time of his decision. In addition, a rational believe does not have to be true, it simply needs to be well supported by the available information. (For example, if the only available information about the universe came from our sight, then it would be rational to believe that the Earth was flat and the Sun went around it).

A second objection is that a self-destructive activity cannot be consistent with rationality and that the rational addiction model implies that addicts – since they act rationally and maximise their utility – are *happy*, while in real life they are often depressed and in even in deep physical and mental distress. Again, even assuming this last claim to be true, this reasoning shows poor comprehension of the model: maximizing utility does not imply to achieve happiness, on the contrary, the model suggests that many individuals become addicts *precisely* because they are unhappy. However, they would be even more unhappy if they were prevented from consuming addictive goods.

Arguably one of the most active opponent of Becker's theories, philosopher Jon Elster, notable proponent of Analytical Marxism and critic of Neoclassical Economics, in a number of works among which it is worth mentioning *Ulysses and the sirens* (1977) and *More than enough* (1996), although recognizing the importance of Becker's works in applying economic theory to new issues, points out many theoretical and logical objections to Becker's model, some of which directly related to rational addiction.

The most convincing part of Elster works is definitely the one that deals with consistency in time preferences and stability of tastes, and it is not by chance that such an issue is also the

one upon which we can find more empirical studies not consistent with Becker and Murphy's model, as we will see in the next section.

The best point made by Elster concerns preferences formation and the attempt by Becker to explain them within the rational choice model. What Elster strongly rejects is the notion that some preferences can be tracked back to a rational choice made by an individual for the very purpose of acquiring those preferences. It is actually very hard to think that people may take steps to reduce say their rate of time discounting, since wanting to be motivated by long-term concerns *ipso facto* is to be motivated by long-term concerns.

However, when it comes to rational addictions Elster's critiques are less effective and often show some lack of good faith. Even not mentioning what frankly cannot be regarded as nothing but arrogance in remarks as "for those unused to the reasoning of economists, this whole discussion may seem entirely superfluous and my conclusions so obviously true that no argument are needed", the philosopher's points are often misleading and sometimes show a very weak comprehension of the mathematical implications of Becker's model, which are by the way never challenged. Coming to what we called lack of good faith, we would like to point out that although Elster's stance is merely theoretical and is not meant to produce any empirical evidence on its side or against the rational addiction model, the philosopher often claims that the empirical evidence evidently contradicts Becker and Murphy model, which is something that, paraphrasing Elster's own words on Becker's theories, is "frankly weird".

One of Elster's arguments is that the rational addiction model is inconsistent with the behaviour of many addicts who wish to end their addiction, but cannot manage to do it. This objection can be easily rejected since such a behaviour simply shows that the desire to end the addiction and the future benefits that will follow do not have for the addict a bigger value than the cost of adjustment. Moreover, the behaviour indicated by Elster, where the addict finds himself torn between two opposed desire (say overeat and good health) has ben well explained by Dockner and Feichtinger in their model of cyclical consumption, which implies multiple stocks of consumption capital with opposite relations to current consumption.

Elster also makes a distinction between chemical and behavioural forms of addictions (gambling and overeating, for instance) and between those addictions that have the capacity to alterate one's thought, mood and consciousness, and those which do not. This may at first sight look as a distinction that is worth making and it probably is, but it is not relevant as far as this discussion is concerned. It does not make any difference whether the addictive behaviour is driven by a chemical effect or a behavioural one, as long as the results are the same: this is indeed one case in which Milton Friedman's *as-if* approach does work. Elster undoubtedly makes a good point when he says that it is impossible to establish whether an

individual indulges in addictive activities because the exposure to the activity itself raises his discount rate on the future or because the activity impairs his awareness and judgement (as it happens with alcohol, for example), but we frankly do not see how this could work as an argument against the rational addiction model. Moreover, if it is true – and it definitely is – that Becker cannot tell the difference between the two scenarios, the opposite is true also: Elster himself cannot tell the difference either, but this would never be considered a proof of anything at all.

Elster of course is not the only philosopher to have questioned the rational addiction model, but it seems that none of these new opponents has brought any new and really interesting arguments to the table. On the contrary, the main problem with this works (a good example is Ole Rogeberg's "Taking absurd theories seriously: Economics and the case of rational addiction theories") is that they usually display the same overconfidence noticed in Elster, but again no formal challenge of the mathematic model nor any scientific or empirical test in support of their thesis. The rational addiction model is often misrepresented and misquoted, but most important, it seems to us that the criticism is often made only on the basis of what looks like an ideological hostility towards neoclassical economics *per se*, which also bring the authors to incautious critics of the use of mathematics in economics, an issue they are not in the position to discuss. Again, it is hard to contain one's amazement when such works claim that there is no empirical evidence to take rational addictions seriously.

IV. Empirical evidence of rational addiction

The rational addiction model has been tested on a wide range of addictive goods, with data set from different countries, at both the level of the individual consumer and the level of the market. All the tests have generally showed consistency with its predictions.

If a good is not an addictive no effect of past or future consumption on current consumption should be found. If it is an addictive one but individuals behave according to the myopic model, past consumption should have some positive influence on current consumption, but future consumption and prices should have no effect on current consumption.

We report here the empirical results for three different kind of addictive good: cigarettes, cocaine and alcohol.

The case of cigarettes

Arguably one of the most wide spread addictions in the world, cigarette smoking is an ideal example for testing the rational addictions model since: consumption is legal, restrictions are less strict than with alcohol and reliable data are available at large.

Applying the model to a pooled data set of the states of the U.S. from 1955 to 1985, Becker, Grossman, and Murphy found that cigarette smoking is an addictive behaviour that does not show any consistency with the myopic model, and although full rationality cannot be assessed either, the results generally support the model of rational addiction. According to their results therefore, both past and future consumption significantly impact current consumption and future prices influence current consumption in a way that is consistent with the Becker and Murphy model.

Further evidence in support of these rational addiction model has been provided by Frank J. Chaloupka using micro data set from the National Health and Nutrition Examination Survey. Chaloupka finds that the effect of past consumption on current consumption is always significant at the one per cent level and the effect of future consumption is significant at least the five per cent level in all but some of the general models.

Becker, Grossman and Murphy also report that a 10% permanent increase in the price of cigarettes reduces current consumption by 4% in the short run and by 7,5% in the long run, while Chaloupka's findings show that past prices have a larger effect on present consumption than future prices. His estimation of long-run elasticity of demand falls in the range from -0.36 to -0.27 for the full sample and in the rang from -0.46 to -0.30 for current smokers.

Similar results also emerge in Keeler, Hu, Manning, and Barnett from data on per capita consumption of cigarettes in California from 1980 to 1990. Again, we can clearly find that an increase in past consumption raises current consumption and that short-run price elasticity is significantly lower than long-run price elasticity.

The estimates for the various education and age groups tend to support Becker and Murphy model, as individuals with fewer years of formal education or younger ones actually seem to behave more myopically than more educated or older counterparts. In particular, for less educated or younger individuals past consumption and consumption capital have significant positive effects on current consumption, while future consumption has a statistically insignificant impact. On the other hand, for more educated or older individuals both past and future consumption have a statistically significant positive effect on current consumption, implying a relative low rate of time preference. In addition, less educated individuals show a

significant long-run response to changes in price, while more educated ones are found to be quite unresponsive to changes in prices.

All these results are consistent with Becker and Murphy hypothesis since they shows that present-oriented individuals will be more affected by the market price of the addictive good than future-oriented ones. This is due to the fact that for present-oriented individuals the negative future effects on utility play a minor role in the computation of the full price of the addictive consumption.

Where the empirical data does not fully support the model however, is in the relation Becker and Murphy draw between addictive goods and stressful events. The results on the issue are mixed: greater divorce rates are associated with higher level of cigarette consumption, however, there seem to be no relation between cigarette consumption and unemployment.

The case of cocaine

Taking part to the debate on drug legalization Grossman, Chaloupka, and Brown apply the rational addiction approach to address the question whether legalization of drugs would have a positive effect on consumption. Leaving aside the debate on legalization (which is extremely interesting but not relevant for the present discussion), we can still use some of their findings to look for elements of consistency with the rational addiction model.

Their estimates show that the effects of both past and future consumption are significantly positive on current consumption, while the price effects are significantly negative. This clearly indicates that cocaine consumption is an addictive good, but also rules out the hypothesis that cocaine consumers are myopic, since current consumption is affected by future consumption and price.

Consistently with the rational addiction model the long-run elasticity of demand is substantial and is approximately twice as large as the short-run elasticity (it falls in the range from -1.26 to -1,56)

The case of alcohol

The application of the rational addiction model to alcohol is more complicated. The reason is that one of the peculiarity of alcohol is that, differently from other addictive goods, its consumption is much more continuous than the bimodal distribution that is likely to characterize the consumption of other addictive goods such as cigarettes, cocaine and heroin. The consequent problem is that aggregate data from all age group are easily dominated by the behaviour of moderate and light drinkers. This means that in order to analyse addictive

behaviour it could be necessary to focus on the age groups that show the highest level of alcohol overconsumption.

Consistently with this premises, Grossman, Chaloupka, and Sirtalan (1995) employ the data formed from the nationally representative cross-sectional survey of high school seniors conducted each year since 1975 by the Institute for Social Research of the University of Michigan. The members of the panel range in age from seventeen through twenty-seven years old, which is a particularly good interval since other studies, including the National Health Interview Survey (1988) and Grant (1991), report that the prevalence of alcohol dependence and abuse is highest precisely among this age group. In particular, alcohol abuse and addiction falls from 17% for people aged eighteen through twenty-nine to less than 2% for people aged sixty-five and over.

Their estimates clearly indicate that alcohol consumption is addictive in the sense that increases in past or future consumption cause current consumption to rise. Although we have general evidence in support of the rational addiction model, and no element in support of the myopic consumption hypothesis can be found at all, estimates are not fully consistent with Becker and Murphy model since they show discount factors implausibly high.

Dealing with the effects of price changes on consumption, the long-run price elasticity is approximately 60% larger than the short-run price elasticity. A major implication is that any forecast of increases in tax revenues through excise tax hikes would be considerably overstated and forecasts of reduction in consumption would be considerably understated if they did not take into account the long-term price elasticity in the rational addiction framework.

These results have been confirmed also by Waters and Sloan (1995) whose study also shows – consistently with Becker and Murphy - that consumption by younger and poorer people demonstrates higher sensitivity to all money prices. However, this pattern cannot be found for other kind of "prices" such as fines and criminal punishment. One explanation could be that the effect predicted by the rational framework could be obscured by other factors: poorer and under-age people are more likely to consume alcohol at home, laws are less strictly enforced in poorer neighbourhoods, people with lower incomes are less likely to own a car, etc.

V. Time-inconsistent preferences

Becker and Murphy model imposes two assumptions on the consumer behaviour: the first is forward-looking decision making, and the second is that consumers are time consistent.

Although the first one is very hard to impugn and has become a key assumption in the development of alternative models too, the second one, under which the marginal rate of

substitution (MRS) between consumption in *t+1* and *t* is constant and equal to the discount rate, is clearly contradicted by psychological evidence and experiments which reveal that consumers have a lower discount rate when making decisions over time interval further away than for ones closer to the present. In other words, under time-inconsistent preferences the MRS between consumption at two future dates is not constant and depends on the date at which it is evaluated.

It needs to be stressed however that there is very little non-experimental evidence for time-inconsistency in decision making, but there is *no* evidence that supports time-consistent preferences either

The most common form of time inconsistency is *hyperbolic discounting* (Strotz, 1956) where MRS decreases with the horizon resulting in a *salience effect* (Akerlof, 1991) on immediate consumption as opposed to delayed consumption. In other words, under hyperbolic discounting individuals do not evaluate future utility streams in the same manner at different dates.

A time-inconsistent choice is one that would not have been made if it had been contemplated from a removed, dispassionate perspective; it is the result of a transient alteration in tastes rather than a re-evaluation of an alternative due to receipt of new information. A possible explanation of time inconsistencies has been provide by Danile Kahneman and Amos Tversky and is related to the concepts of *reference point* and *adaptation*. The *reference point* reflects the fact that people might be less concerned with absolute attainments than with attainments relative to some psychologically relevant comparison point. *Adaptation* rises every time a consumer does not any longer regard the purchase of a good as hypothetical and gets used to the idea of its consumption before actually owning it: in this case failing to own the product is not neutral any more, but results in deprivation, that is to say disutility.

Gruber and Koszegi argue that Becker and Murphy model and its empirical applications run into a number of critical problems.

First of all, all the tests rely on the assumption that individuals do forecast prices far in advance, which is not always the case since very few price increases are announced this far in advance. It is conceptually difficult therefore, to conceive individuals who are able to forecast well future prices and it can be easily found that excise tax changes are rarely known one year in advance.

Second, the dependent variable in BGM's regression is cigarettes sales, not consumption: this means that if individuals really did anticipate future price changes, then it would be consistent

with the rational framework for individuals to stockpile cigarettes while they are less expensive. Of course, if the price change is far in the future stockpiling is not likely to occur, but as we said before, far future price changes are also difficult to anticipate, so when anticipation is most easy is precisely when stockpiling is most likely to happen.

Third, and perhaps most importantly, BGM test is unable to distinguish true future price effects from other long-term effects which are unlikely to remain fixed. For instance, it has been shown (Showalter, 2000) that future prices are correlated with current consumption and that an oligopolistic tobacco manufacturer facing a relatively inelastic demand for cigarettes would react to declining consumption by raising prices.

Testing the model on cigarette smoking, Gruber and Koszegi suggest an alternative kind of test: examining how consumption changes when a tax increase is actually announced, but not yet effective. Their analysis, based on the legislative history from 1973 to 1996 and on two different sources of data on cigarette consumption (the annual data used by BMG and others along with the monthly sales data) shows a strong negative effect of current tax on consumption, with a price elasticity of -0.8, which is significantly higher than that found by BMG. In addition, a price increase within a month that is announced but not effective yet has a positive effect on cigarettes sales, as consumers hoard cigarettes at lower price for future use. This so-called "hoarding effect" is consistent with the rational addiction framework since it shows that consumers have a rational ad forward-looking behaviour, but also implies that sales will most sharply fall in the long term.

The important point made by Gruber and Koszegi is that even when we manage to demonstrate forward looking behaviour among consumers, this does not necessarily imply time consistency. Since smoking is a short-term pleasure and the psychological evidence indicates that time inconsistency is most prevalent with short horizons, their test formulation should be especially fruitful.

Gruber and Koszagi point out that there are two key features to distinguish time-consistent and time-inconsistent agents. The first is the use of *commitment devices* or *self-control techniques* as opposed to alternative technology for smoking cessation such as quitting aids: whereas quitting aids decrease the disutility from not smoking, self-control devices lower the utility from smoking. Time-consistent decision makers would rather use a quitting aid than a self-control device since lowering the utility of an undesired alternative would be irrelevant. On the other hand, for time-inconsistent agents, self control devices are valued as a way to struggle one's own time-inconsistent tendencies. A rather common example are social

incentives such as betting with friends and inform them about the decision or developing various form of self punishment.

The second feature that distinguishes time-consistent agents from time-inconsistent ones is an inability to actualize predicted or desired future levels of smoking. We can actually find two kind of time-inconsistent agents: *naive* agents and *sophisticated* agents. *Naive* agents are impatient in the sense that they attach extra value to the present relative to the future, but they are unaware of they future self-control problems, in other words: *naive* agents maximize their intertemporal utility unconscious of the fact that their future selves will change their plans. *Sophisticated* agents on the other hand, are aware of their self-control problem: self *t* knows that self *t+1* is going to be willing to do something other than what self t would have him to do, therefore the best thing self *t* can do is to make a plan he knows self *t+1* will follow. The approach that has just been exposed is often called *multi-selves game theory* since each individual is regarded as the collection of different selves that are incarnation of the same individual at different dates.

An attempt to restore the unity of the individual as a single self has been made by Caillaud, Cohen, and Jullien (1999) who argue that individuals often follow rules and principles that result in "plans of action". This approach does internalise logical inconsistencies such as the re-initializing of the plan by the individual. In facts, if the individual is a sophisticated agent he will structure his plan in a way that at any time it will be more expensive to quit and re-initialise the plan rather than continuing it.

VI.The European School survey Project on Alcohol and other Drugs (ESPAD)

The use of addictive substances among young people is of great concern in most countries and many studies have been undertaken in order to improve the understanding of consumption patterns. The main purpose of ESPAD is precisely to collect comparable data on substance use among 15-16 years old Europeans students in order to monitor trends within and between countries. The 2007 ESPAD is based on 35 national surveys united by a common project plan and standardized methodological guidelines.

We report here some of the results of the 2007 survey for different substances and goods.

Cigarettes

The legal minimum age for smoking is 18 years old in all countries except Austria, Belgium and some Swiss canton where the minimum age is 16. What it is important to remember however, is that in most countries (with the exclusion of Austria, Estonia, Finland, Germany, Hungary, Ireland, Lithuania, Portugal and some part of Switzerland) the minimum age is not

for cigarette smoking, but for cigarette purchasing, meaning that it's not smoking itself to be illegal, but the purchase of cigarettes.

Tab . 1 Data on cigarette consumption

	Average	Males	Females
<u>Perceived Availability</u> Students replying that cigarettes are *very easy* or *fairly easy* to obtain	72%	74%	71%
<u>Lifetime Consumption</u> Students replying that they have smoked at least once during their lifetime	59%	59%	58%
<u>Recent Consumption</u> Students replying that they have smoked at least once during the last 30 days	29%	28%	29%

As we see from the data, almost three quarters of the students replied that they found very easy or fairly easy to get hold of cigarettes if they want, and almost 60% claims to have smoked at least once.

As we can see from Fig. 1, no clear geographical pattern can be found, although it can be quite safely stated that students reporting higher rates of smoking are likely to live in central and eastern European countries rather than in the Mediterranean ones, with the exception of Spain. Particularly low figures are reported in Armenia, the only country where more than half of the students does not perceive as "very easy" or "fairly easy" to obtain cigarettes and where less than one out of four students has ever tried smoking.

At the aggregate level the gender differences are not very significant, however this is not always the case for individual countries as we can see in Fig.2, where we report the case of 14 countries in which we observe a gender difference of more than five percentage points in recent consumption. No clear geographical pattern can be found for gender differences either, but we can observe that in the countries where recent smoking is above average the most-frequent smoking are girls (with the exception of Latvia, Lithuania, Russia and Ukraine).

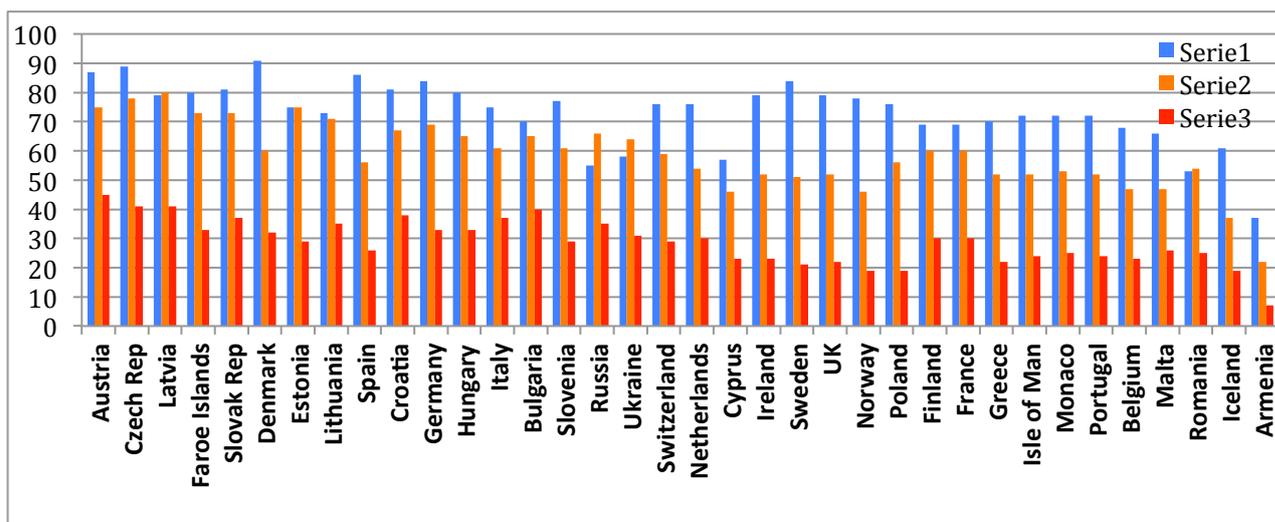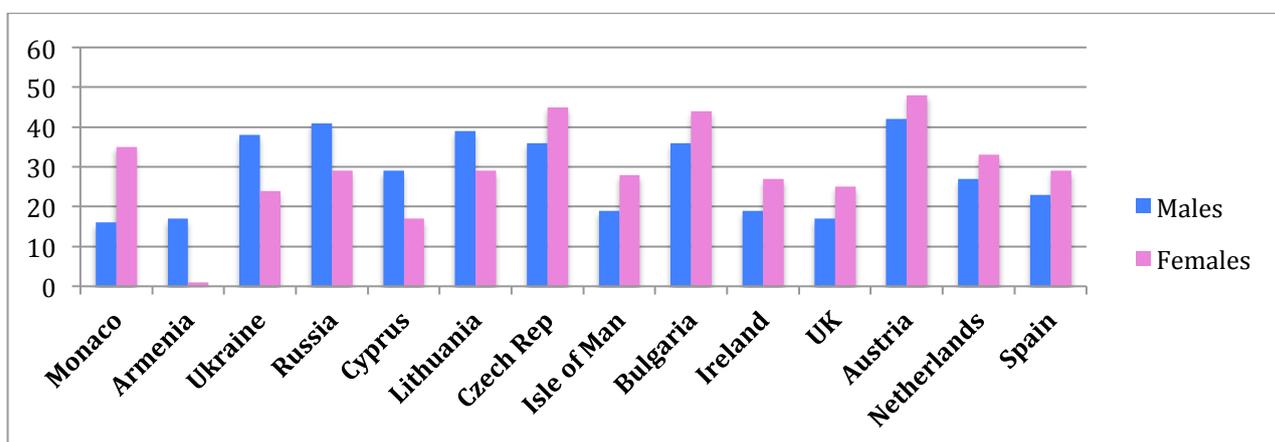**Fig. 1 Perceived Availability (1), Lifetime use (2) and 30 days use 3) by country**

Fig. 2 Gender difference in recent cigarette consumption in selected countries

Tab. 2 Correlations

	Perceived Availability	Lifetime use	30 days consumption
Perceived Availability	-	**0,64**	**0,55**
Lifetime Use		-	**0,90**
30 days consumption			-

According to Tab.2 there is a very strong statistical correlation between lifetime use of cigarettes and recent consumption (r = 0,90), as we can also see in Fig.4. Still significant, but lower is correlation between lifetime use of cigarette and perceived availability of it (r = 0,64) in Fig.3, and even lower the correlation Lation between the latter and recent consumption (r = 0,55).

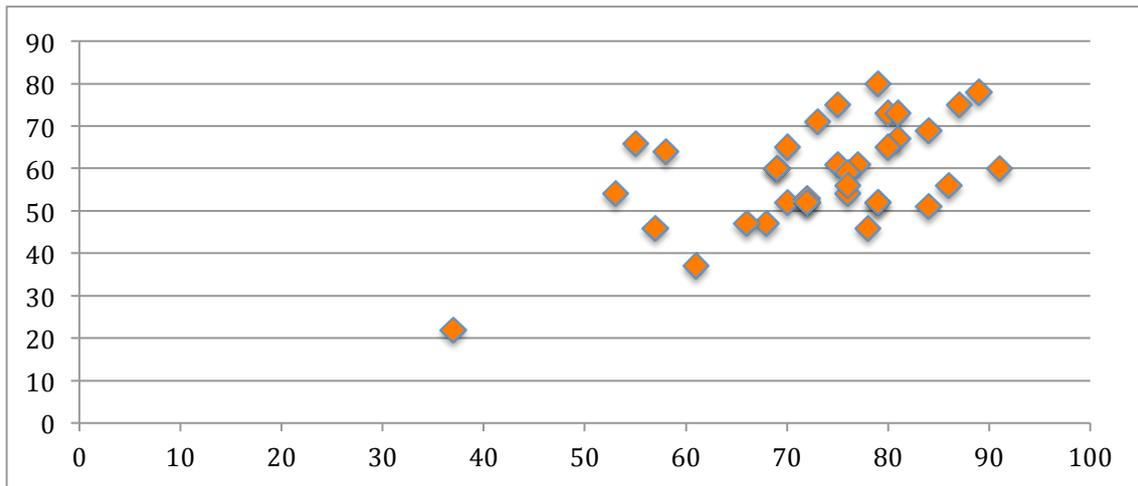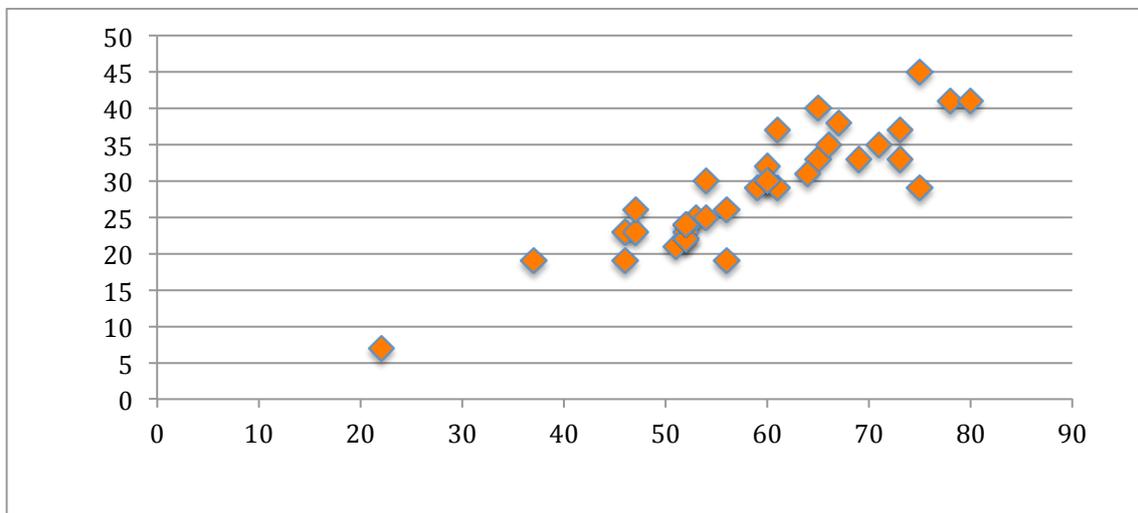**Fig. 3 Correlation between perceived availability and lifetime use**

Fig 4. Correlation between lifetime use and recent use (30 days)

We also looked for correlations between the consumption of cigarettes by minors and the level of education of their parents (Tab.3) and the results in Tab.4 clearly show that a higher level of parents' education has a negative effect on cigarette consumption.

Tab.3 Parents level of education

Degree	Father (esp37)	Mother (esp38)
1. Completed primary school or less	9.05%	8.04%
2. Some secondary school	13.02%	11.62%
3. Completed secondary school	26.43%	28.58%
4. Some college or university	9.44%	10.81%
5. Completed college or university	26.25%	29.02%
6. Do not know	13.96%	10.82%
7. Does not apply	1.85%	1.11%

Tab.4 The assosiaction between cigarette consumption in the last 30 days and father education (esp37), mother education (esp38)

		Coeff.	Std. Err.	z	P>|z|	[95% Conf. Int]	
esp37							
	1	.003953	.0171893	0.23	0.818	-.0297375	.0376435
	2	-.0512287	.0153729	-3.33	0.001	-.0813591	-.0210983
	3	-.0552794	.0186295	-2.97	0.003	-.0917925	-.0187663
	4	-.1793315	.015545	-11.54	0.000	-.2097991	-.1488639
	5	-.0010726	.0169941	-0.06	0.950	-.0343805	.0322352
	6	-.0767122	.0328151	-2.34	0.019	-.1410286	-.0123957
esp38	1	.0471234	.0182671	2.58	0.010	.0113207	.0829262
	2	-.0096589	.0159961	-0.60	0.546	-.0410106	.0216929
	3	-.0225491	.0186832	-1.21	0.227	-.0591675	.0140694
	4	-.1164043	.0160817	-7.24	0.000	-.1479238	-.0848847
	5	.0105915	.0186521	0.57	0.570	-.025966	.047149
	6	-.0392078	.0412779	-0.95	0.342	-.120111	.0416955

We wanted to test then if a similar kind of relationship could be observed also for higher levels of economic wealth (Tab.5) and the results in Tab.6 unsurprisingly show that a level of wealth that is under the average has a positive effect on the cigarette consumption. Un other words, higher levels of economic wealth have a negative impact on cigarette consumption.

Tab.5 Family economic wealth

Degree	Father (esp39)
very much better off	5.46
much better off	10.06
better off	23.99
about the same	52.37
less well off	6.50
much less well off	1.12
very much less well off	0.50

Tab.6 The assosiaction between cigarette consumption in the last 30 days and family wealth (esp39)

		Coeff.	Std. Err.	z	P>|z|	[95% Conf. Int]	
esp39							
	2	-.0758192	.0207474	-3.65	0.000	-.1164833	-.035155
	3	-.110374	.0184929	-5.97	0.000	-.1466194	-.0741286
	4	-.089969	.017498	-5.14	0.000	-.1242645	-.0556735

	5	.0536397	.0223067	2.40	0.016	.0099194	.09736
	6	.1511021	.03892	3.88	0.000	.0748202	.2273839
	7	.352829	.0536986	6.57	0.000	.2475817	.4580762

Alcohol

The minimum age for drinking is 18 years old in most European countries with the following exceptions:

- Austria: 16

- Belgium, Denmark, Germany and Switzerland: 16 for beer and wine, 18 for spirits

- Malta and Cyprus: 17

- Finland, Norway, Sweden: 18 for ABV < 22%, 20 for ABV > 22%

- Iceland: 20

Again, as for cigarettes, in most of the countries the minimum age deals with the purchase of alcohol and not with the consumption of alcohol, with the exception of Austria, Cyprus, Estonia, Finland, Hungary, Ireland, Lithuania, Malta and Ukraine, where it is not just illegal to purchase alcohol under the minimum age, but also to drink it.

**Tab.7 Data on alcohol consumption**

	Average	Males	Females
1.Perceived Availability Students replying that alcoholic substances are *very easy* or *fairly easy* to obtain	68%	69%	67%
2.Lifetime Consumption Students replying that they have tried alcohol least once during their lifetime	89%	90%	89%
3.Recent Consumption - Students replying that they have used alcohol at least once during the last 12 months	82%	82%	82%
- Students replying that they have used alcohol at least once during the last 30 days	61%	63%	60%

A very interesting observation from Tab.7 is that the percentage of students who find "very easy" or "fairly easy" to obtain alcoholic beverages (68%) is substantially smaller than the percentage that claims to have used alcohol at least once (89%). The explanation of this figure has several parts. First of all, alcoholic substances are seen by minors as a kind of *taboo* or

transgression, meaning that minors will actually take chances for consuming alcohol even when it is perceived as rather difficult to obtain. Secondly, in many countries the presence of a minimum age does not imply an effective enforcement of it: alcohol purchasing or consumption under age, even when illegal, might be tolerated or very rarely sanctioned. Finally, even with strict enforcement of the minimum age laws at the selling point (grocery stores, bars, pubs, restaurants, …) minors can still have access to alcohol in contexts where it has been purchased by older people, not last their own families.

Again, it is hard to establish any geographical pattern, but as with cigarettes it is safe stating that central and eastern European countries are more likely to show figures above the average.

Fig. 5 Perceived Availability (1), Lifetime consumption (2), 12 months consumption (3), 30 days consumption (4)
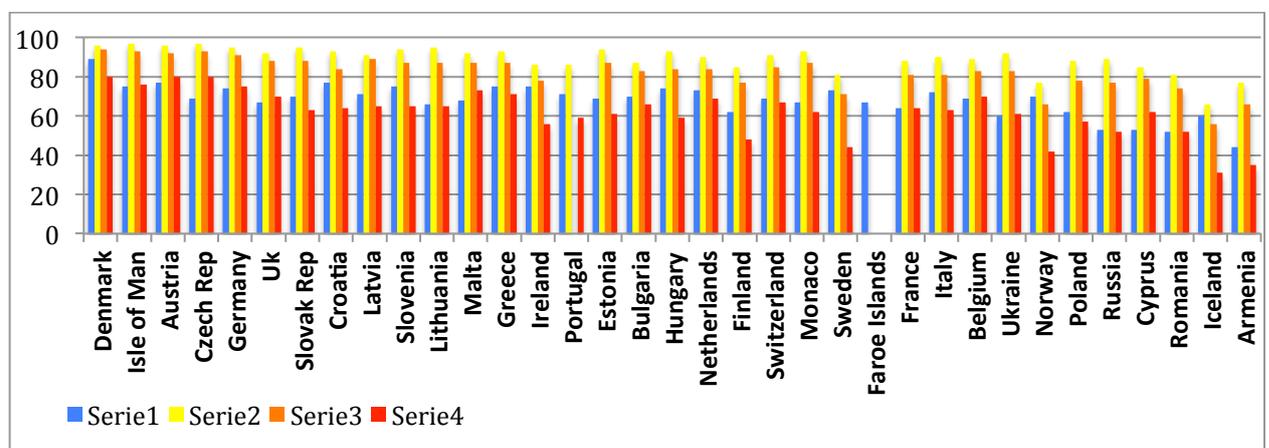
Although less significant than for smoking, gender differences do again become larger as the consumption frequency increases, but in this case the most frequent drinking are boys. There are however countries where girls are more frequent drinkers than boys: Iceland (+7%), Norway (+7%), Sweden (+6%), Estonia (+4%), Finland (+3%), UK (+2%). The geographic pattern is pretty clear here: girls in Nordic countries tend to drink more than boys.

**Fig. 6 Gender differences recent alcohol consumption in selected countries**
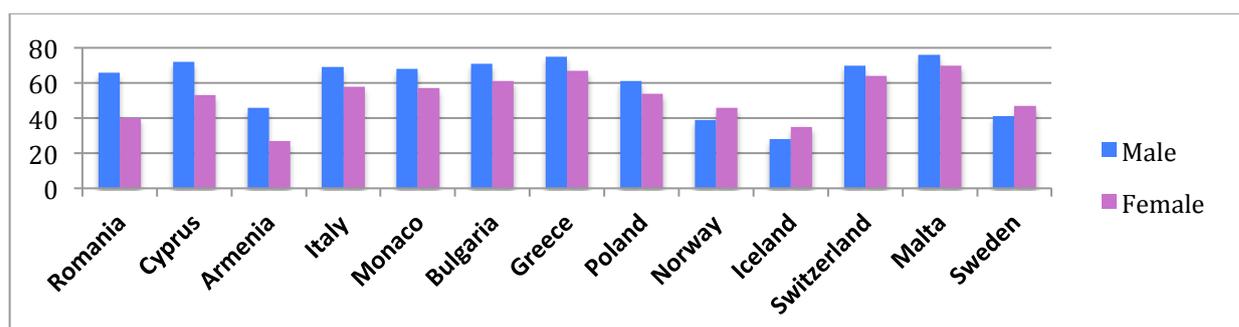
Tab. 8 Correlations

	Lifetime use	12 months use	30 days consumption
Lifetime Use	-	**0,97**	**0,86**
12 months use		-	**0.93**
30 days consumption			-

As we can se in Tab.8 correlations between lifetime use and recent use of alcohol are even stronger than the correlations observed for cigarettes and this is also reflected by following graph.

**Fig. 7 Correlation between lifetime use and last 12 months use**
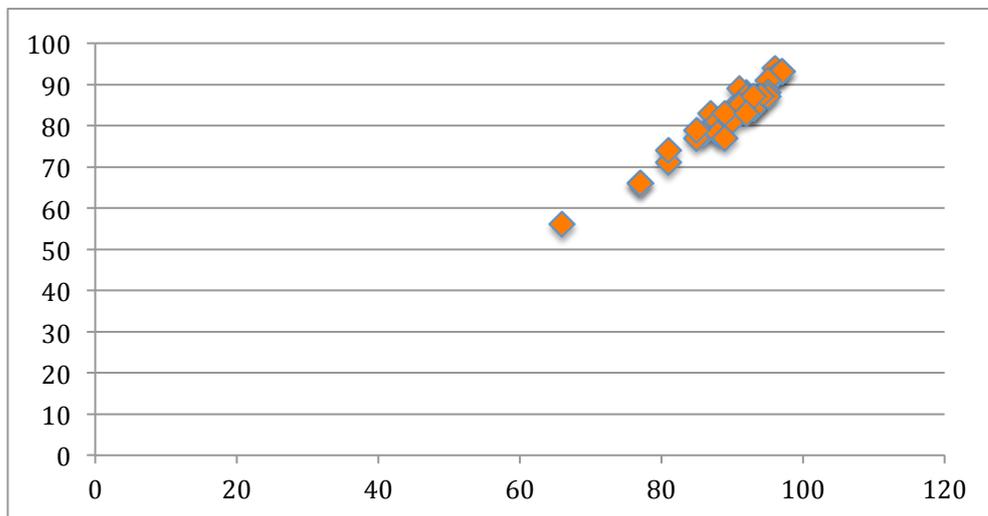
The estimation of the average amount of pure alcohol consumed by students on the last alcohol-drinking day is done by simply adding the alcoholic component of each drink the student had on the last day he or she drunk alcohol. The underlying idea is to spot not just the frequency of drinking, but also its intensity to see if there are discrepancies between the two.

Tab. 9

Estimated Average Consumption	Average	Males	Females
cl of pure alcohol assumed during the last drinking day	4,2 cl	4,8 cl	3,5 cl

Fig. 9 Estimated average consumption of pure alcohol during the latest alcohol-drinking day (cl)
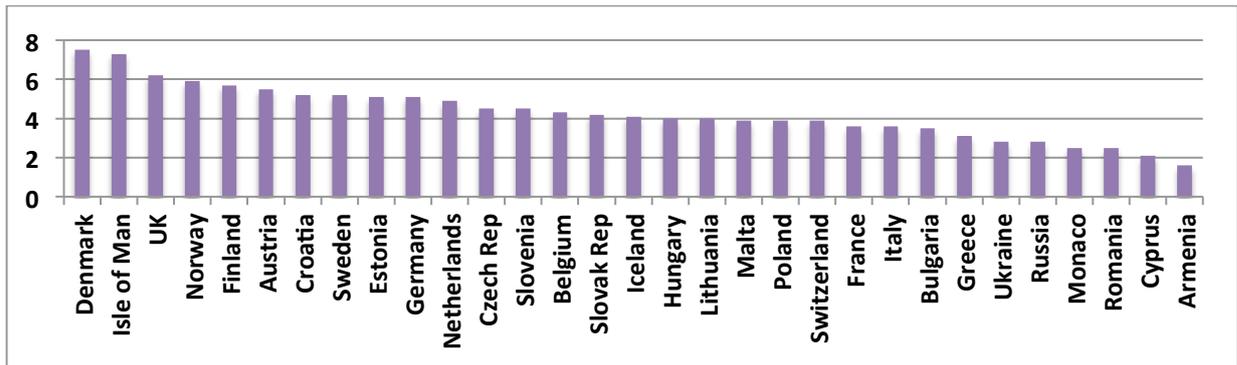
On the aggregate country level there is no statistical association between countries with higher frequency in consumption and countries where higher amounts of alcohol were consumed on the last drinking day. The correlation between alcohol use in the last 30 days and the amount consumed in the last alcohol-drinking day is very weak: $r = 0,27$. This figure has a very interesting interpretation: in many countries drinking is less frequent precisely because the amounts usually consumed are smaller and vice versa. This is no strange phenomenon: in southern countries (Greece for instance) drinking can be very diffuse, but in moderate and regular quantities, on the other hand, in many Nordic countries drinking is somehow restrained in some periods (usually during the week) and then tolerated even in excessive amounts in other periods (usually on the weekends).

Fig. 10 Correlation between recent consumption and amount of alcohol consumed on the last drinking day
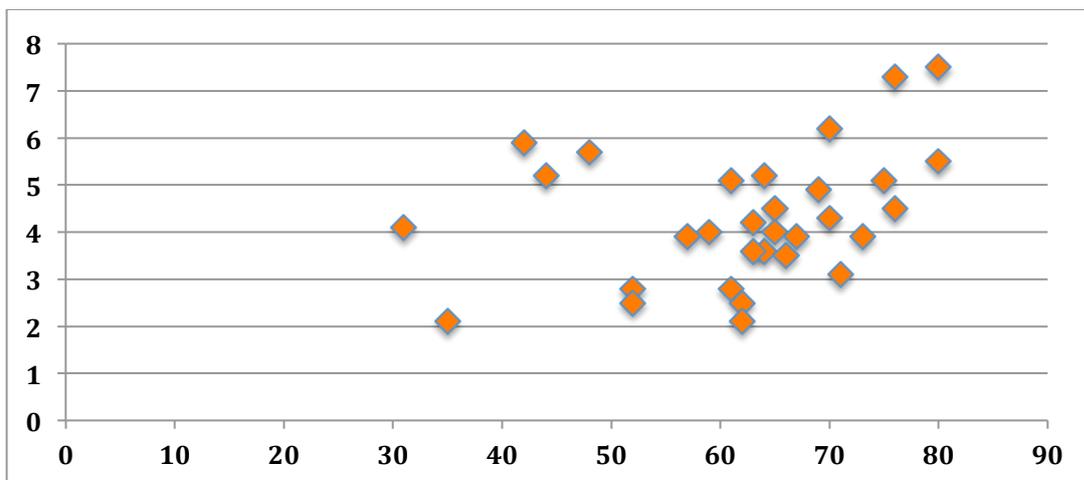
Here are some examples: countries above average for frequencies such as Czech Rep. (+14%), Malta (+12%), Greece (+11%), are on average (Czech Rep.) or even significantly

below average (Malta and Greece) for quantity. Conversely, countries that are way under the average for frequency, such as Norway (-19%), Finland (-14%) and Sweden (-13%) are all above average for quantities. It is probably by no chance that Norway, Finland and Sweden are also the countries with the strictest regulation on minimum age and it would be interesting to test whether these figures are the cause of such stricter regulation or represent a failure of it. Of course we have some exceptions too: Austria, Denmark, Germany, Netherlands and UK are all well above the average for both frequency and quantities.

Although in general we can say that larger amounts are consumed by boys, we can also observe some interesting pattern in gender differences across the ESPAD countries: differences are larger in countries that have a general score below the average and smaller in countries that have a general score above the average. A geographical pattern here is quite clear again: girls tend to drink as much and sometimes even more than boys in Nordic countries like Finland, Iceland, Norway and Sweden.

Students were also ask to answer how many times they have been intoxicated by alcohol in their lifetime, in the last 12 months and in the last 30 days (Tab.10). On average, half of the students in the ESAPD countries reported having been drunk at least once during their lifetime, but the differences between countries are quite significant, as we can see in Fig. 11.

Tab. 10 Alcohol abuse and intoxication

Alcohol Abuse and intoxication	Average	Males	Females
- Students replying that they have been drunk at least once during their lifetime	50%	51%	48%
- Students replying that they have been drunk at least once during the last 12 months	39%	40%	38%
- Students replying that they have been drunk at least once during the last 30 days	18%	19%	17%

Fig.11
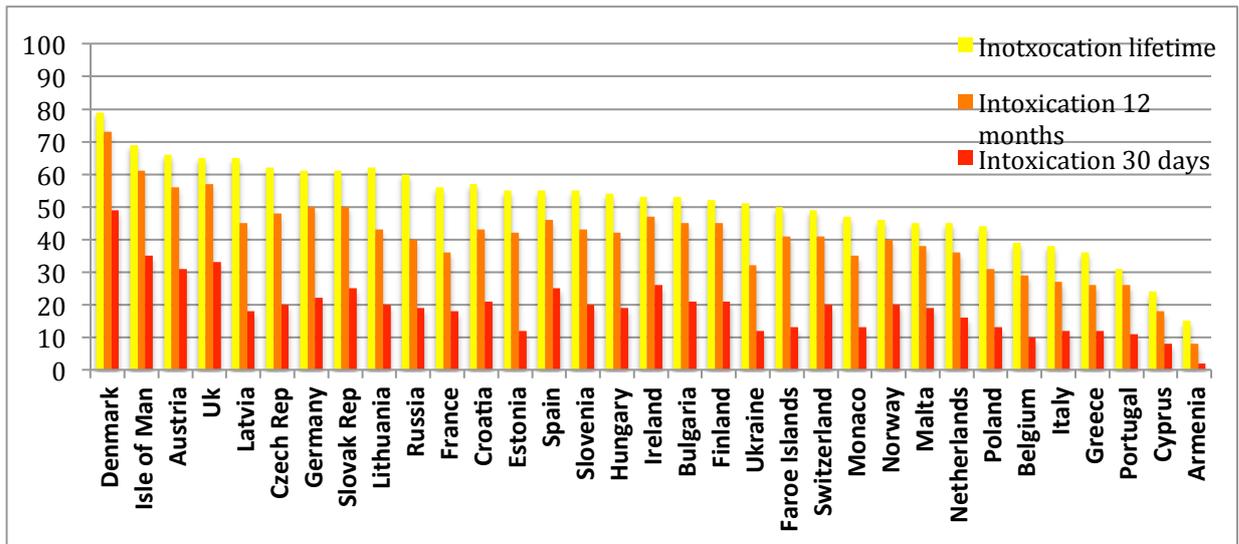
In the majority of countries boys report intoxication experience more often than girls. However, what it is interesting to observe is that, again, when we look at the gender differences they are usually larger in countries where intoxication experiences are below the total average and smaller in those countries that score above the average. Actually all the countries where girls reported intoxication more often than boys are all above the general average: Finland, Ireland, Isle of Man, Norway, Monaco, Spain, Sweden and UK. Conversely, all the countries that show large differences between girls and boys are below the average.

Fig.12 Gender differences for alcohol intoxication in the last 30 days in some countries
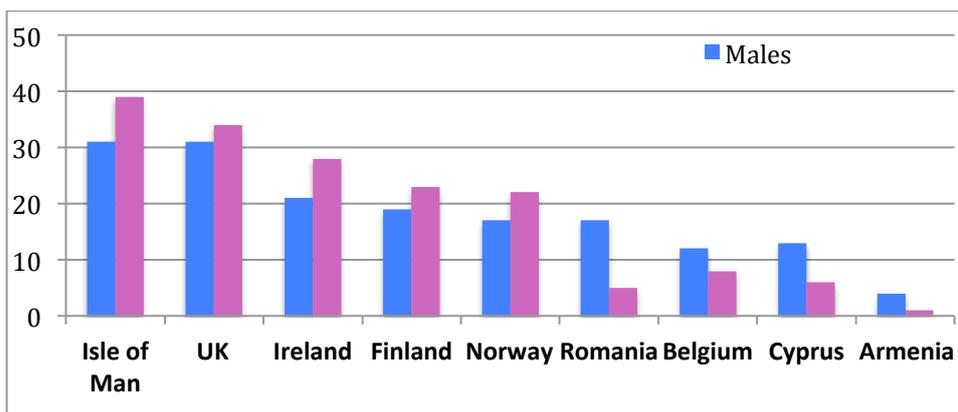
In Tab.11 we can find the correlation coefficients for alcohol intoxication. It is quite evident that higher level of intoxication in the last 12 months are likely to be found in countries where students have been intoxicated at least once during their lifetime (r = 0,94). It is no surprise then, that the level of intoxication in the last 30 days is highly correlated with the level of intoxication in the last 12 months (r = 0,93). We can see these correlations in Fig. 12 and 13.

Tab. 11 Correlations

	Lifetime Intoxication	12 months Intoxication	30 days Intoxication	5+ drinks last occasion
Lifetime Intoxication	-	0,94	0,82	0,43
12 months intoxication		-	0,93	0,52
30 days consumption			-	0,47
5+ drinks last occasion				-

The questionnaire also asked to the students how many times in the last 30 days they had had at least five drinks on the same occasion. The idea behind this question is to measure alcohol abuse in a more standardized and less subjective way, since consuming five of more drinking would certainly cause most students of this age to reach some level of intoxication, while the concept of "being drunk" might be subjective. A summary of the data is presented in Tab.12 and Fig.15.

Tab. 12 Episodic heavy drinking

|	Average	Males	Females
- Students replying that they have had at least 5 drinks on one occasion during the last 30 days	43%	47%	39%

Fig.15 Students replying that they have had at least 5 drinks on one occasion during the last 30 days
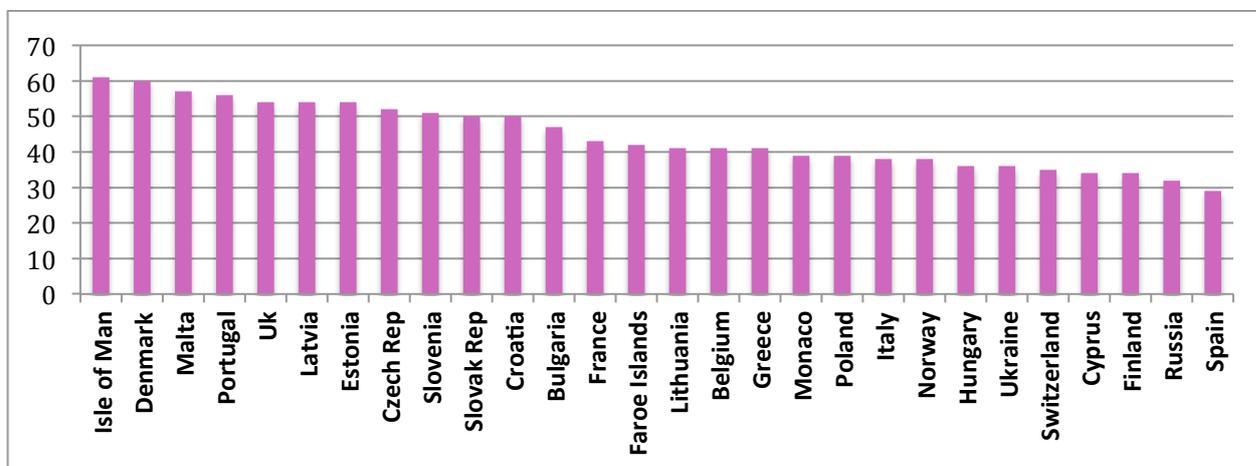
Heavy drinking in the last 30 days is in general more common among boys than among girls, although we have some exceptions: Iceland, Norway, Sweden and Uk. This is a geographic pattern we have already found for alcohol drinking and confirms the above the average use of alcohol by girls in Nordic countries.

The first thing we notice is that the average of the students who claim to have had five or more drinks in the last 30 days (43%) is considerably higher than the percentage of those who claimed of having been drunk in the last 30 days (18%). The correlation between the two statistics is showed is actually lower then expected (r = 0,47) and is not significant at the 0.01 level. This fact is quite problematic and has to deal with two fundamental problems: first the number of students who got intoxicated is easily underestimated for the social stigma that might attached to drunkenness at such a young age, secondly, the definition of "drink" is not very precise and may vary from country to country.

Fig.16 Correlation between heavy drinking in the last 30 days and intoxication in the last 30 days
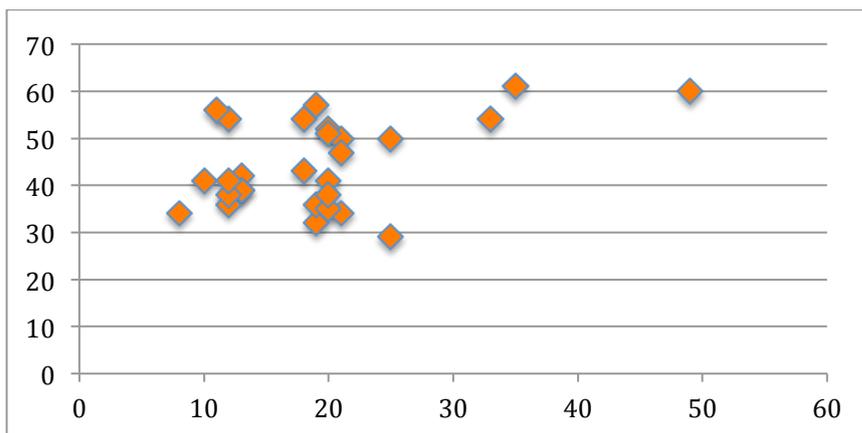
One of the aims of the Espad questionnaire is also to point out what are the differences in the students' perception of alcohol consumption. Such differences do not vary only between people, but also between countries due to the different cultural and social attitude towards alcohol and its consumption. Different cultures do not only promote different use of alcohol, but also attach different judgment to its use and abuse, which has a very strong psychological effect on alcohol users. According to the rational addictions framework, when choosing whether to consume an addictive good each individual takes into consideration the discounted value of the benefits and the costs of its use and takes his decisions accordingly. Therefore, it would be interesting to look for patterns between countries with high rate of alcohol consumption and countries where alcohol drinking has a positive perception or is expected to have positive effects, and vice versa. Of course this is very far from proving anything in favor

or against the rational addiction framework, and honestly not even in favor or against forward looking behavior, but it could still be an interesting pattern to observe. In Tab.13 we summarize some of the results of ESPAD questionnaire on alcohol expected effects. Although the data for all countries are not available, we can observe that with the only exception of Ukraine, all the countries that report expected positive effects score above the average for all the alcohol drinking statistics. On the other hand, we can observe that many (but not all) of the countries where negative effects outweigh positive ones show below-the average data for the alcohol drinking statistics.

Tab. 13 Expected Negative and Positive consequences of alcohol consumption

Very Positive Effects	Positive Effects	Neutral	Negative Effects	Very Negative Effects
UK Isle of Man Czech Republic Ukraine	Austria Belgium Denmark Estonia Germany Hungary Ireland Malta Netherlands Norway Sweden Russia	Armenia Bulgaria Slovak Republic	Croatia Cyprus Greece Latvia Portugal Slovenia Switzerland	Italy Lithuania Poland Romania

The correlation between positive anticipated effects and alcohol consumption in the last 30 days is not particularly high (r = 0,20) as we can see from Fig.16. However it definitely is higher when we look at the correlation with intoxication in the last 30 days (r = 0,50) as we can see from Fig.17.

Fig.16 Correlation between alcohol effects perception and its consumption in the last 30 days
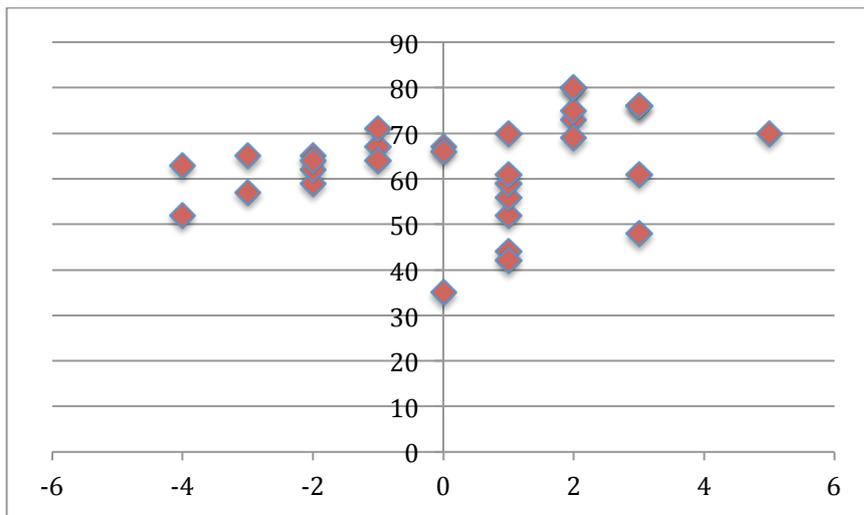

Fig.17 Correlation between alcohol effects perception and intoxication in the last 12 months and the last 30 days
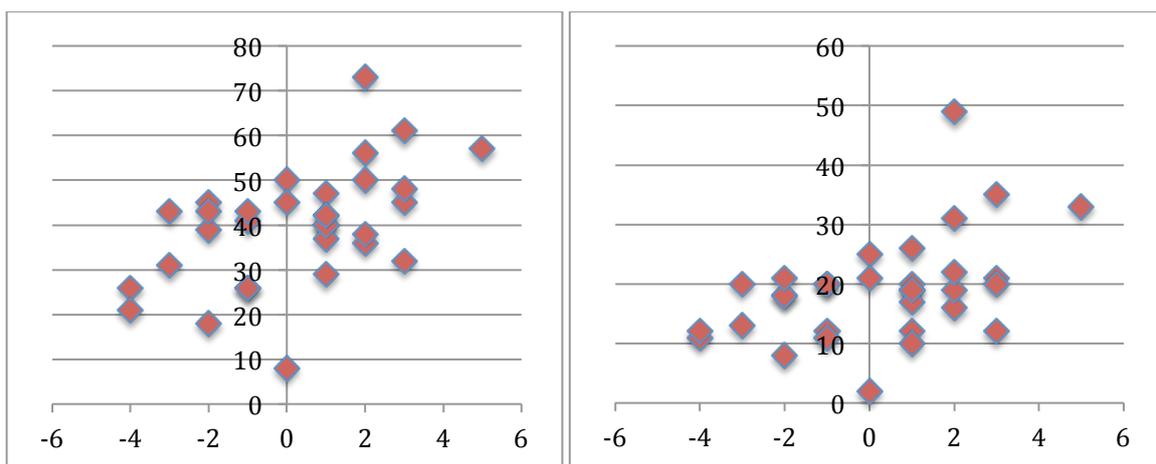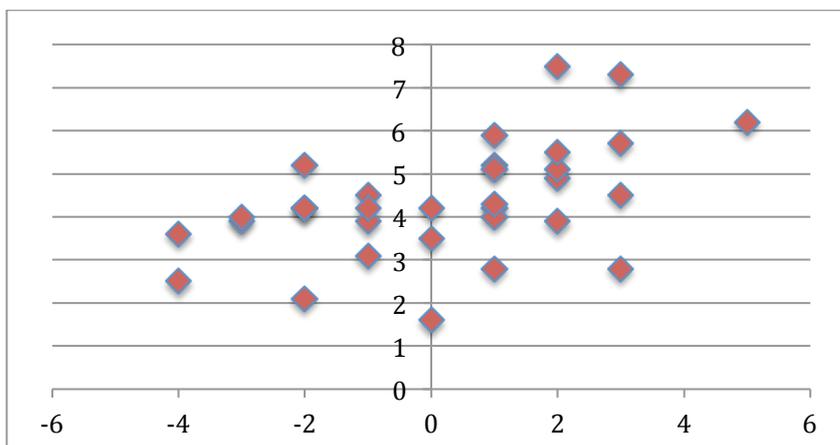

Fig. 18 Correlation between alcohol effects perception and estimated average consumption

As with cigarettes, we wanted to test for correlations between the overconsumption of alcohol and the education of the parents. In order to have a quite objective indicator of "overconsumption" we use the data about "having drinking 5 of more dinks on the last drinking occasion and we regressed it on the parents' level of education as previously reported and the results in Tab.14 again show that higher level of education in the family background have a negative impact on the overconsumption of alcohol.

Tab.14 The assosiaction between alcohol overconsumption in the last 30 days and father education (esp37), mother education (esp38)

		Coeff.	Std. Err.	z	P>|z|	[95% Conf. Int]	
esp37							
	2	.0910825	.0195218	4.67	0.000	.0528205	.1293446
	3	-.0115062	.0179045	-0.64	0.520	-.0465984	.023586
	4	-.0410317	.0209318	-1.96	0.050	-.0820572	-6.14e-06
	5	-.1206412	.0180748	-6.67	0.000	-.1560671	-.0852153
	6	-.0552037	.0195294	-2.83	0.005	-.0934805	-.0169269
	7	-.0062697	.0344546	-0.18	0.856	-.0737996	.0612602
esp38							
	2	.1469302	.020965	7.01	0.000	.1058396	.1880208
	3	.0424422	.0189397	2.24	0.025	.0053209	.0795634
	4	.0118949	.0213697	0.56	0.578	-.029989	.0537788
	5	-.055456	.0190033	-2.92	0.004	-.0927018	-.0182103
	6	.0033186	.0214108	0.15	0.877	-.0386458	.0452831
	7	.0353539	.0424773	0.83	0.405	-.0479002	.1186079

It is no surprise then that that we can spot the same effect also for higher level of wealth as reported in Tab.15. What we can notice however is that only level of wealth that are indicated as "very much less well off" have actually a positive effect on alcohol overconsumption.

Tab. 15 Association between alcohol overconsumption in the last 30 days and family wealth (esp39)

		Coeff.	Std. Err.	z	P>|z|	[95% Conf. Int]	
esp39							
	2	-.0820098	.0211196	-3.88	0.000	-.1234034	-.0406162
	3	-.1246423	.0188157	-6.62	0.000	-.1615205	-.0877642
	4	-.1606131	.0177519	-9.05	0.000	-.1954062	-.12582
	5	-.0813387	.022713	-3.58	0.000	-.1258554	-.0368221
	6	-.0564076	.0398652	-1.41	0.157	-.134542	.0217268

	7	.1489577	.0554414	2.69	0.007	.0402946	.2576209

Illicit drugs

The concept of "illicit drugs" includes marijuana, hashish, amphetamines, cocaine, heroin, crack, ecstasy and LSD or other hallucinogens.

Tab.16

	Average	Males	Females
Lifetime use of any illicit drug	20%	23%	17%

As we can see in Fig.19, lifetime use varies dramatically between countries, but no geographical pattern can be found. In general, boys report higher percentages for lifetime use: the largest differences between gender are reported in Fig.20. As we can see, the only striking exception of Monaco, where girls report values considerably above boys.
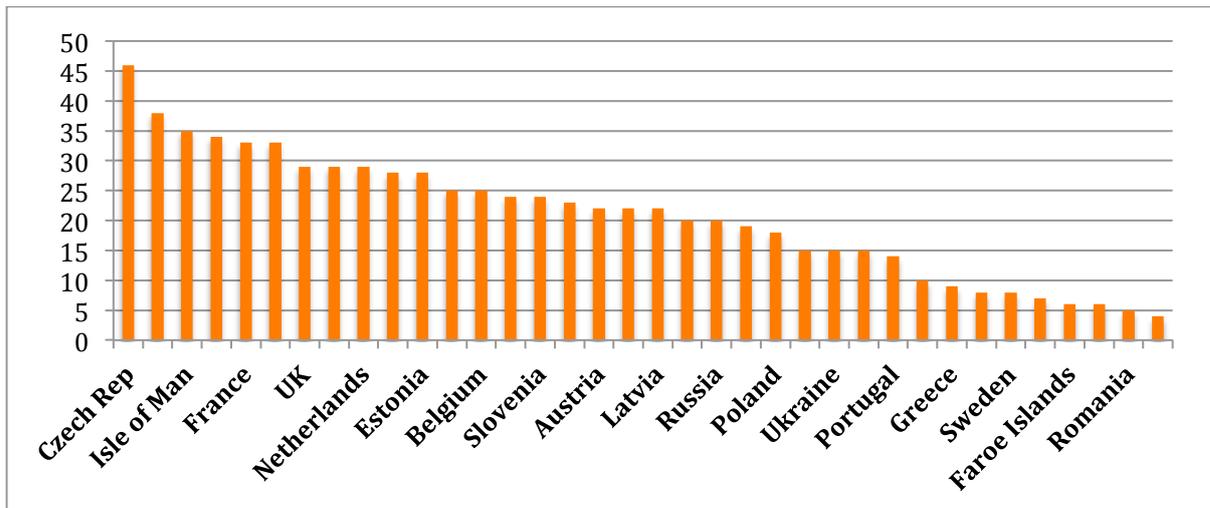
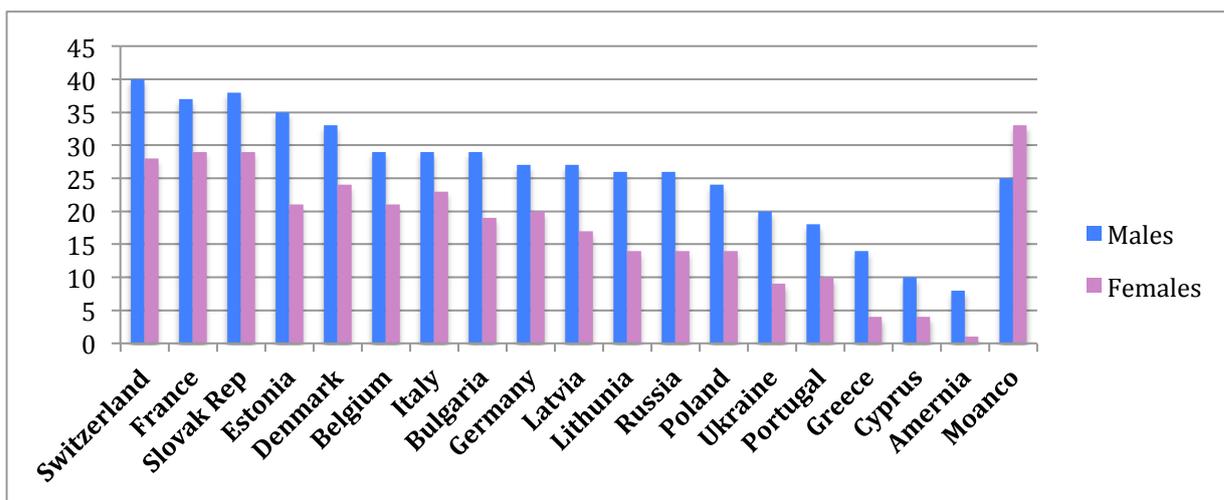**Fig.19 Lifetime use of any illicit drug**

Fig.20 Gender differences in lifetime consumption of any illicit drug

Cannabis

As we can see in Tab.17 the vast majority of students who have tried any illicit drug have used cannabis: we can actually see that the figure for lifetime use of cannabis is only one percentage point below the figure for lifetime use of any drug. This is true not only at the aggregate level, but also if we pick each country separately, with the only exceptions of Austria an Latvia, where lifetime use of cannabis scores five percentage points below the average.

The statistical correlation between these two variables is almost perfect: r = 0,99, meaning that countries that score high in any illicit drug lifetime use are very likely to score high in cannabis lifetime use too and vice versa.

It is no surprise then that the gender differences are essentially the same reported for any illicit drug.

Tab.17

|	Average	Males	Females
Perceived Availability Students replying that marijuana is *very easy* or *fairly easy* to obtain	33%	35%	31%
Lifetime Consumption Students replying that they have tried marijuana once during their lifetime	19%	22%	16%
Recent Consumption - Students replying that they have used	14%	16%	12%

marijuana at least once during the last 12 months			
- Students replying that they have used marijuana at least once during the last 30 days	7%	9%	6%

Fig.21 Use of Cannabis country by country
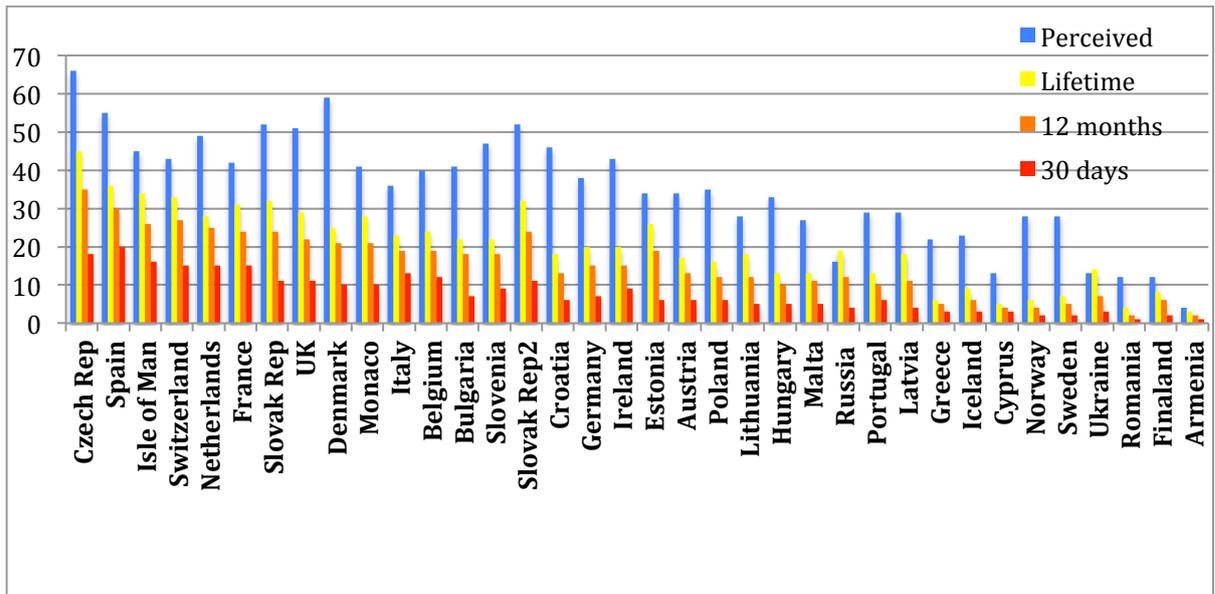
As we can see in Fig. 22 the correlation between lifetime use and last 12 months use is almost perfect with r = 0,99, while for the correlation between last 12 months use and last 30 days use we have r = 0,96.

Fig. 22
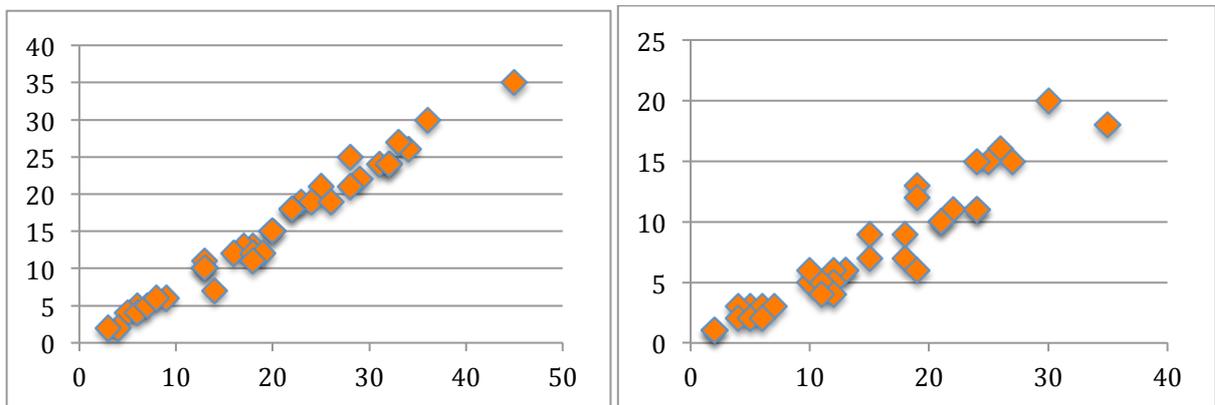
A quite striking observation we made about cannabis consumption is that, differently from alcohol and cigarettes, higher levels of education in the family background do not have any negative impact on consumption (Tab.18). This does not mean that the coefficients of lower

levels of education are not higher, as they actually are, but shows that more education in the family background does not have any negative impact on consumption.

The same fact can be said about the family economic wealth (Tab.19), as levels above the average do not have a significant negative effect on consumption. Again, it must be stressed that we are not saying that levels of wealth under the average do not have larger coefficients, what we are saying is that although coefficients for higher levels are smaller they are still positive, so no negative impact of economic wealth on cannabis consumption can be found.

Tab. 18 Assocaition between cannabis consumption in the last 30 days and father education (esp37), mother education (esp38)

		Coeff.	Std. Err.	z	P>|z|	[95% Conf. Int]	
esp37							
	2	.1429389	.0214923	6.65	0.000	.1008147	.185063
	3	.0676241	.0194729	3.47	0.001	.0294579	.1057904
	4	.1391778	.0229887	6.05	0.000	.0941209	.1842348
	5	.0873816	.0194437	4.49	0.000	.0492726	.1254906
	6	.0164322	.02169	0.76	0.449	-.0260794	.0589438
	7	.0489972	.0404399	1.21	0.226	-.0302636	.128258
	2	.1477645	.0228019	6.48	0.000	.1030735	.1924554
	3	.0928149	.0201964	4.60	0.000	.0532306	.1323991
	4	.1464326	.0231362	6.33	0.000	.1010864	.1917788
	5	.0798057	.0201897	3.95	0.000	.0402347	.1193768
	6	.0123007	.023742	0.52	0.604	-.0342327	.0588341
	7	.0966498	.0499225	1.94	0.053	-.0011966	.1944961

Tab. 19 The association between cannabis consumption in the last 30 days and family wealth (esp39)

		Coeff.	Std. Err.	z	P>|z|	[95% Conf. Int]	
esp39							
	2	-.0160004	.0261963	-0.61	0.541	-.0673441	.0353433
	3	.0559679	.0232128	2.41	0.016	.0104717	.1014641
	4	.0255085	.0221087	1.15	0.249	-.0178237	.0688407
	5	.157575	.0276531	5.70	0.000	.1033759	.2117741
	6	.2579938	.0464611	5.55	0.000	.1669317	.3490558
	7	.4441402	.0623967	7.12	0.000	.321845	.5664354

Illicit drugs other than cannabis

Tab.20

	Average	Males	Females
Lifetime Consumption Students replying that they have used any illicit drug other than marijuana at least once during their lifetime	7%	8%	6%
% of students replying that they have used at least once			

	Average	Males	Females
Recent Consumption of Ecstasy			
- Students replying that they have used ecstasy at least once during the last 12 months	2%	3%	2%
- Students replying that they have used ecstasy at least once during the last 30 days	1%	2%	1%

Fig. 23 Recent use of drugs other than Cannabis by country
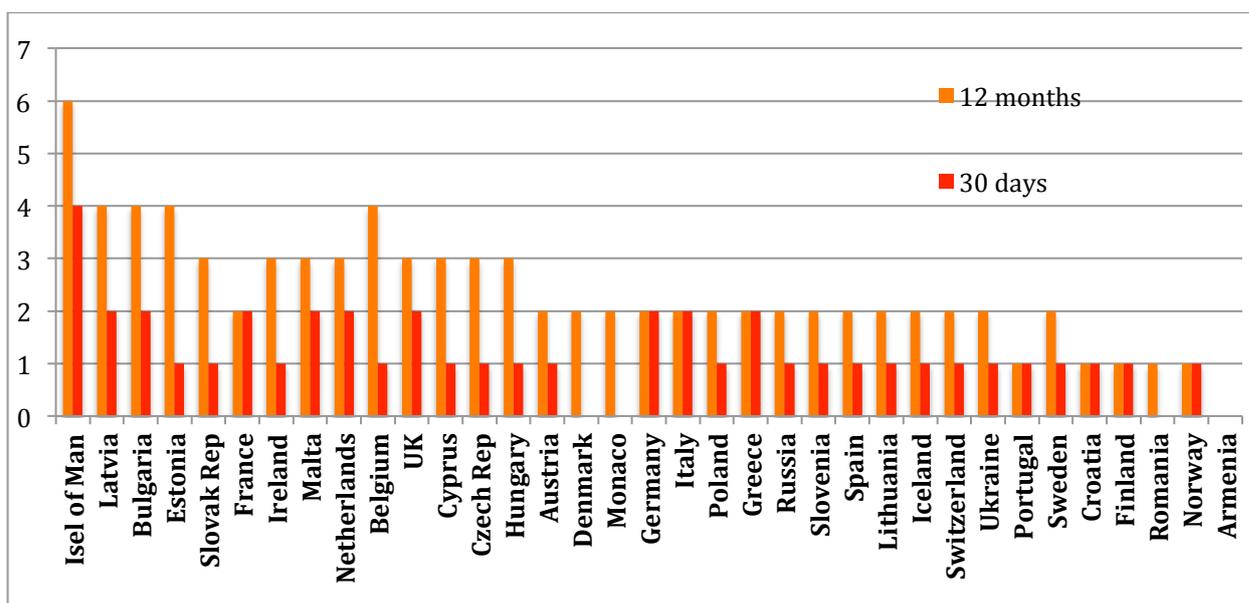
We wanted to see what are the effect of the level of education and economic wealth in the family background for the consumption of ecstasy and cocaine.

For ecstasy, we can see in Tab.2 that higher levels of education and of economic wealth have a negative impact on consumption. For cocaine (Tab.22), things are slightly different, since we can observe that in general all levels of education have a negative impact, while for wealth lower levels clearly have a positive effect on consumption.

Tab.21 Association between ecstasy use in the last 12 months and father education (esp37), mother education (esp38), family wealth (esp39)

		Coeff.	Std. Err.	z	P>|z|	[95% Conf. Int]	
esp37							
	2	-.0339836	.036952	-0.92	0.358	-.1064083	.038441
	3	-.1324081	.0335593	-3.95	0.000	-.1981832	-.0666331
	4	-.1199762	.041388	-2.90	0.004	-.2010951	-.0388572
	5	-.1416034	.0336968	-4.20	0.000	-.2076479	-.075559
	6	-.073203	.0369587	-1.98	0.048	-.1456407	-.0007653
	7	.0143655	.0674989	0.21	0.831	-.1179298	.1466608
esp38							
	2	.0342683	.040122	0.85	0.393	-.0443693	.1129059
	3	-.0648975	.0358134	-1.81	0.070	-.1350905	.0052956
	4	-.0540678	.042088	-1.28	0.199	-.1365588	.0284233
	5	-.0590648	.0357217	-1.65	0.098	-.1290782	.0109485
	6	-.0099472	.0414066	-0.24	0.810	-.0911026	.0712082
	7	.2866878	.0744702	3.85	0.000	.1407288	.4326468
esp39							
	2	-.2113046	.0387126	-5.46	0.000	-.2871799	-.1354292
	3	-.3396592	.0345424	-9.83	0.000	-.4073612	-.2719573
	4	-.4351388	.0322882	-13.48	0.000	-.4984226	-.371855
	5	-.2306514	.0433356	-5.32	0.000	-.3155877	-.1457151
	6	.0723647	.0677042	1.07	0.285	-.0603331	.2050626
	7	.4773963	.0787069	6.07	0.000	.3231337	.631659

Tab. 22 Association between cocaine use in the last 12 months and father education (esp37), mother education (esp38), family wealth (esp39)

		Coeff.	Std. Err.	z	P>|z|	[95% Conf. Int]	
esp37							
	2	-.0612551	.0351475	-1.74	0.081	-.1301429	.0076327
	3	-.1363336	.0316192	-4.31	0.000	-.1983061	-.0743611
	4	-.0411958	.0376356	-1.09	0.274	-.1149601	.0325685

|							
	5	-.1231189	.0315634	-3.90	0.000	-.184982	-.0612558
	6	-.0718348	.0348064	-2.06	0.039	-.1400541	-.0036154
	7	-.004867	.0645286	-0.08	0.940	-.1313408	.1216068
Esp38							
	2	-.0207625	.0366028	-0.57	0.571	-.0925027	.0509777
	3	-.1632788	.032712	-4.99	0.000	-.2273931	-.0991645
	4	-.026628	.037266	-0.71	0.475	-.0996679	.0464119
	5	-.1056169	.0322594	-3.27	0.001	-.1688443	-.0423896
	6	-.0909026	.0381958	-2.38	0.017	-.1657651	-.0160401
	7	.0805829	.0763458	1.06	0.291	-.0690521	.2302178
esp39							
	2	-.2380117	.0377283	-6.31	0.000	-.3119579	-.1640655
	3	-.3249504	.0332283	-9.78	0.000	-.3900767	-.2598241
	4	-.3789844	.0309232	-12.26	0.000	-.4395928	-.3183761
	5	-.2068781	.0413372	-5.00	0.000	-.2878975	-.1258588
	6	.0781936	.0655316	1.19	0.233	-.050246	.2066333
	7	.5893219	.0732115	8.05	0.000	.4458299	.7328139

Tranquillizers and sedatives

It is interesting to notice that according to the data the use of tranquillizers and sedatives on prescription is on average only slightly larger than the use without prescription and that in many country the latter is actually the predominant (Lithuania, Poland, Monaco, Italy, Cyprus, Finland, Estonia and Sweden)
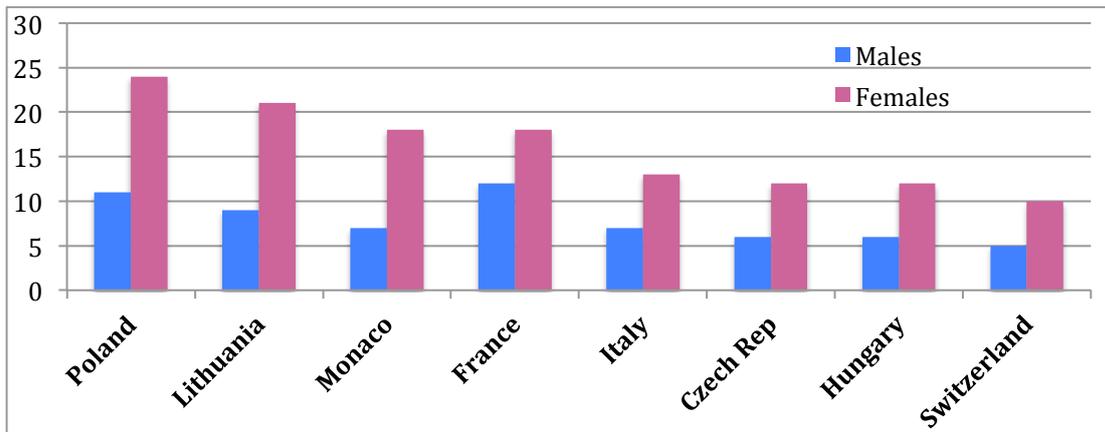
Tab. 23

	Average	Males	Females
Lifetime Consumption			
1) On prescription	8%	7%	8%
2) Without prescription	6%	5%	8%

Fig. 24 Use of tranquiller with and without prescriptions
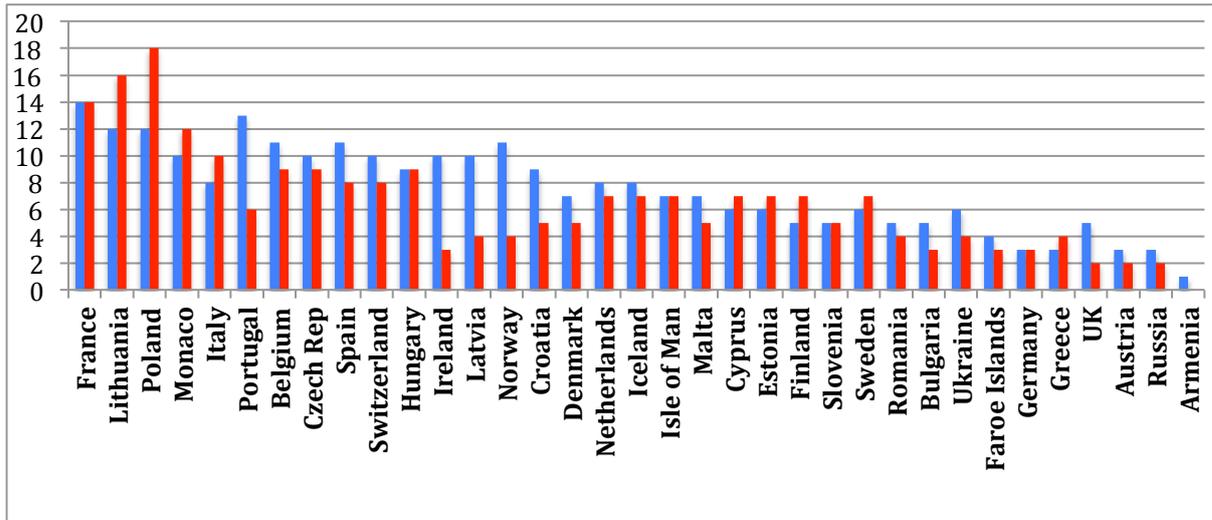
Use of tranquillizers and sedatives without is much more common among girls in almost every ESPAD country.

Fig 25. Gender difference in consumption without prescription

VII. Conclusion

Any attempt to prove or disprove the implications of the rational addiction model goes far beyond the scope of the present work.

What the empirical evidence throughout the decades has shown is that although we do not find full evidence in support of the rational addiction model, we cannot either accept the myopic models as valuable instruments to analyze these kind of behaviors any more. In other words, we need to take into account that there is good evidence that individuals are forward-looking and discount future costs as well as future utility even when dealing with habits and addictions. What most recent studies may show as a critical point however, is that there is very little evidence in support of time-consistency and stable preferences.

However, this should not make us reject the model altogether, as we have seen that, although not all of its aspects are fully supported by the data, many of its core concepts and implications are valid and sound. So, as previously said, there is no need to develop a separate theory to explain behaviors that should be studied and analyzed within the rational choice framework.

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