Dipartimento di Politiche Pubbliche e Scelte Collettive – POLIS
Department of Public Policy and Public Choice – POLIS

Working paper N. 41
April 2004

Rational Addiction to Cinema? A Dynamic Panel Analysis of European Countries

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UNIVERSITA' DEL PIEMONTE ORIENTALE "*Amedeo Avogadro*"
ALESSANDRIA

Rational Addiction to Cinema?

A Dynamic Panel Analysis of European Countries

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ABSTRACT

A number of papers have empirically investigated the rational addiction model proposed by Becker and Murphy (1988) by using data on different harmful drugs, like cigarettes, alcohol, caffeine, opium, cocaine; but also activities independent of a biological or pharmaceutical dependency have been analysed, such as gambling, calorie consumption, news, arts, and cinema. The purpose of this paper is to extend previous works on cinema demand by using pooled cross-section and time-series data on thirteen European countries over the period 1989-2002. The estimation results provide a strong evidence that cinema consumption conforms to a rational addiction hypothesis.

Key words: panel dynamic analysis; cinema; rational addiction; European conuntries.

JEL classification: C6, D2, Z1.

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1. Introduction

The rational addiction model proposed by Becker and Murphy (1988) has become a standard approach in the analysis of addictive goods. A number of papers have empirically investigated the model by using data on different harmful drugs, like cigarettes (Chaloupka, 1991; Becker et al., 1994), alcohol (Grossman et al., 1995; Waters and Sloan, 1995; Bentzen et al., 1999), caffeine (Olekalns and Bardsley, 1996), opium (Van Ours, 1995; Liu et al., 1999), cocaine (Grossman and Chaloupka, 1998).

As already stated in Becker and Murphy (1988), people can be addicted to most every product or activity independently of a biological or pharmaceutical dependency. Hence, the model has been tested with gambling (Mobilia, 1993), calorie consumption (Cawley, 1999; Levy, 2002), news (Dewenter, 2002), and arts (Villani, 1992). A further good that is suitable for empirical tests of the rational addiction model is cinema. A number of studies deal with this topic (Fernández Blanco and Banos Pino, 1997; Cameron, 1999; Macmillan and Smith, 2001; Dewenter and Westermann, 2002), but all these studies only focus on cinema attendance within a single country.

In this paper we extend the analysis of the demand for cinema to thirteen European countries (Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Norway, Netherlands, Spain, Sweden, United Kingdom) by using pooled cross-section and time-series data over the period 1989-2002. There are at least two good reasons for thinking that there are gains from an empirical dynamic study of state-disaggregated cinema markets. First, it is likely that geography matters for the cinema consumption of a country, such as to justify studying state-disaggregated models. Secondly, applying dynamic panel data models may control for all time-invariant variables or state-invariant variables, whose omission could bias the estimates in a typical cross-section or time-series study.

The proceeding of this paper is the following. Section 2 presents the theoretical framework of the rational addiction model. Section 3 describes the data set to be used. The econometric specification is shown in Section 4. Section 5 summarises the empirical findings. Section 6 concludes.

2. Theoretical Background

A consumer is said to be addicted to a consumption good if an increase in past consumption leads to an increase in present consumption ceteris paribus (Becker et al., 1994). This behaviour is usually assumed to involve reinforcement and tolerance (Bask and Melkersson, 2001). Reinforcement means that an increase in past level of consumption increases the craving for present consumption. On the other hand, tolerance means that the satisfaction from a given level of consumption is lower when past level is greater. However, some consumers, described as being 'myopic', may have such a high rate of preference for present consumption (and discount the future so heavily) that the impact of tolerance effects on current consumption are negligible, and positive reinforcement effects of previous consumption on the marginal utility of current consumption can cause the demand for a habit-forming good to soar to persistently high levels.

Following Becker et. al. (1994), utility of an individual at time t depends on the consumption of two goods, a non-addictive good, x_t, and an addictive good, c_t, and on the impact of a set of unmeasured life-cycle variables, e_t. A simple way to distinguish the consumption of two goods is to assume that current utility for the addictive good also depends on a measure of past consumption of c. To this aim, Becker et al. (1994) introduced the habit stock, $S_t = c_{t-1}$, as a measure of the degree of addiction at time t.

Assuming a constant rate of time preference, σ, and a infinity lifetime the concave and time-separable utility function (in c_t,x_t and c_{t-1}), would be

(1) $$U = \int_0^{\infty} e^{-\sigma t} u[x_t, c_t, c_{t-1}, e_t] dt .$$

Utility is negatively affected by c_{t-1} in the case of harmful products; by contrast, in the case of harmless product, previous consumption can also have a positive effect on individual health, such as the case of cinema consumption.

Consumer consumption's choices are constrained by the consumer's wealth, W, and the prices of c and x at time t, respectively p_{ct} and p_{xt}. Assuming p_{xt} as a numeraire, the consumer faces the following budget constraint.

(2) $$\sum_0^{\infty}(1+r)^{-t}(p_{ct}c_t + x_t) = W$$

where p_{ct} the price of the addictive good and W is the consumer's wealth. As consumer is forward looking, also discounted stream of future prices puts a constraints on the consumer's consumption choices. Maximizing equation (1) under this life-time budget constraint, one can obtain the optimal path of consumption for c and x. A standard technique used in literature to derive a structural demand function for consumption of c is to approximate the instantaneous utility function in the neighborhood of steady-state by a quadratic function in the arguments. Assuming a rate of time preferences equals to the market interest rate, i.e., $\sigma = r$, the demand equation for c can be derived as

(3)[1] $$c_t = \theta_1 c_{t-1} + \theta_2 c_{t+1} + \theta_3 p_{ct} + \theta_4 e_t + \theta_5 e_{t+1}, \quad \text{with } \theta_2 = \delta\theta_1 \text{ and } \delta = \frac{1}{1+r},$$

where the θ's are parameters which depend on the underlying preferences.[2] Equation (3) nests different behaviors. Since a good is addictive if and only if an increase in past consumption leads to an increase in current consumption, a zero value of θ_1 implies a non-addicted consumer. Only when $\theta_1 > 0$, forces that increase past or future consumption, such as lower past or future prices of addictive goods, lead to an increase in current consumption, throughout an intertemporal substituting process, and past, present and future consumption are complements. Testing for rational addiction is testing for forward looking behavior. An addicted but myopic consumer is not farsighted, according to a simply backward looking consumer decision, while a rational addicted consumer takes into account consequences of past, current and future information. The rational model implies that the coefficient on future consumption should have the same sign as the coefficient on lagged consumption (the sign differ only by the term δ). Only if $\theta_2 > 0$, a change in future events lead to an increase of current consumption.

Another advantage of this specification is that using the characteristic roots of the second-order difference equation in (3), λ_1 and λ_2[3], one can derive the short- and long-run relationship between consumption and prices in form of elasticities, respectively η_s e η_l, computed, at sample means, as (Dewenter, 2002):

[1] From the rational addiction model a parameter restriction is imposed on eq. (2), i.e. $\theta_2 = \delta\theta_1$.[1] Testing this parameter restriction - the null hypothesis of reasonable values of δ implied by the estimated parameters - has been used in the literature as a 'test' of the validity of the rational addiction model (Cameron, 1998).

[2] An alternative to the rational addiction model – known as 'habit persistence' - allows for the effect of past consumption on current consumption, but ignores the effects of future addictive behaviour on current consumption (McGuiness and Cowling, 1975; Fujii, 1980; Baltagi and Levin, 1986).

[3] The characteristic roots are derived as $\lambda_{1,2} = \frac{1 \pm (1 - 4\theta_1\theta_2)^{1/2}}{2\theta_1}$. As they are conditions for a maximum, they measure the response of current consumption on variation in future or past consumption respectively. As long the utility function is concave in c_t and c_{t-1}, the signs of the roots are positive, if addictive behavior is present.

(4) $$\eta_s = \frac{\theta_3}{\theta_1(1-\lambda_1)\lambda_2}\frac{\overline{p}}{\overline{c}}$$

and

(5) $$\eta_l = \frac{\theta_3}{\theta_1(1-\lambda_1)(\lambda_2 - 1)}\frac{\overline{p}}{\overline{c}},$$

where $\overline{c}$ and $\overline{p}$ are the sample means, respectively of c and p_{ct}.

3. Data

This section provides a brief description of the data sets used in this paper. The data consists of aggregate national annual time series from 1989 to 2001 for thirteen European countries.[4] In particular, the theoretical framework is investigated using the following variables:

(i) *Cinema consumption*: cinema consumption, *adm*, is measured as the average cinema attendance per inhabitant per year. This variable is the quotient of the annual attendance in a year divided by the total population. The data are from *European Cinema Yearbook*, published by Mediasalles.

(ii) *Price*: the price of cinema consumption, *pri*, is measured as the deflated average annual ticket price at box-office.[5] This variable is built as the ratio between the annual total receipts in a year and the number of tickets sold. The data are supplied by the above mentionated publication *European Cinema Yearbook.*

(iii) *Other Determinants*: this vector comprises additional factors that may exert some influence on cinema consumption. In particular, an increase in per capita income, *inc*, displays an ambiguous impact on cinema demand. In fact, cinema demand is expected to rise with income increase; but, at the same time, an increase in income level leads to a growth of opportunity costs. The per capita GDP has been deflated by CPI index. The data are from *Annual Statistics*, published by *World Bank.*

Furthermore, the quality of product supplied seems to be an important determinant of admissions. To this aim, the number of screen per km squared, *scr*, is introduced in the final specification of the model. In fact, during nineties the introduction of multiplex has improved the quality of cinema viewing throughout the use of a superior audiovisual technology. The data are from *European Cinema Yearbook*, published by Mediasalles.

Finally, as pointed out in Fernández Blanco and Prieto Rodriguez (2003), competition in movie industry is another important determinant to explain cinema demand. Both production and distribution side of European cinema market are controlled by Hollywood majors. Nevertheless, in some countries, such as France, Germany, Italy, Spain and UK, there is space for the co-existence

[4] Austria, Belgium, Denmark, Finland, France, Germany, Italy, Luxembourg, Norway, Netherlands, Spain, Sweden, United Kingdom.

[5] Due to the lack of data, we do not take account of a second component of price, basically, expenses for transport, as in Fernández-Blanco and Baños Pino (1997).

of a strong domestic movie industry, making an effective competition throughout the creation of a national star system or by specializing in those movie fields that American majors are less interested in, such as author's picture, or reflective films. The national domestic movie production, *mov,* is measured as the number of domestic movies per year as reported in the *European Cinema Yearbook,* published by Mediasalles.

Descriptive statistics are reported in Table 1.

[TABLE 1]

4. Empirical Specification

According to the theoretical model and the variables suggested in the previous sections, the empirical specification of the demand function for cinema is:

(6) $$adm_{i,t} = \alpha_0 + \alpha_1 adm_{i,t-1} + \alpha_2 adm_{i,t+1} + \alpha_3 pri_{i,t} + \alpha_4 inc_{i,t} + \alpha_5 scr_{i,t} + \alpha_6 mov_{i,t} + \varepsilon_{i,t},$$

where subscript *i* and *t* stand respectively for the country and the period considered and $\varepsilon_{i,t}$ is the error term.

The direct estimation of equation (6) may give rise to some misleading results and some caution is necessary. First step in the analysis is to test the hypothesis that data can be pooled. Following Levaggi and Zanola (2003), F-tests are performed on the null hypothesis that the coefficients for each variable in equation (6) are the same for each year. Results are reported in table 2. The null hypothesis of equal coefficients could not be rejected in either case, therefore we can pool the data.

[TABLE 2]

Next step is to test the stationarity of the variables included in the model. In order to determine the presence of panel unit root we employ the IPS t-bar tests (Breitung, 2000). The panel tests include a heterogeneous time trend in their specifications. Table 3 shows that the null of unit root could not be rejected and hence the series are I(1) processes. When testing the series in first differences all time series appear to be stationary or I(0) processes.

[TABLE 3]

Therefore, equation (6) is estimated in first differences, such that:

(7) $$\Delta adm_{i,t} = \alpha_0 + \alpha_1 \Delta adm_{i,t-1} + \alpha_2 \Delta adm_{i,t+1} + \alpha_3 \Delta pri_{i,t} + \alpha_4 \Delta inc_{i,t} + \alpha_5 \Delta scr_{i,t} + \alpha_6 \Delta mov_{i,t} + \varepsilon_{i,t}$$

where Δ is the first difference operator.

5. Results

Taking first differences will induce a first-order moving average process into the trasformed residuals, and since we have potentially endogenous variables on the right hand side, we must rely on instrumental variable techniques to get consistent estimates[6]. Since the estimator that uses differences as instruments suffers from singularities as well as large variances (Arellano, 1989), we instrumented endogenous variables with lagged and led levels of each variables in (6). Due to over-identification, we adopt the generalized method of moments (GMM) which is proved to be an appropriate method to have a consistent estimator when the number of instruments is higher than exogenous variables, as is the case here (Hamilton, 1995). Instruments validity is checked using the difference in difference Sargan test for over-identifying restrictions[7] (Sargan, 1958; Hensen, 1982). Table 4 summarizes the main results.

[TABLE 4]

The estimation results provide a strong evidence that cinema consumption conforms to a rational addiction hypothesis. Both the coefficient on past and future consumption are positive and significantly different from zero, so that past and future changes significantly impact present consumption. The evidence is inconsistent with the hypothesis of myopic behaviour. We also notice that $\theta_1 > \theta_2$ as expected. This finding supports the hypothesis that a high rate of time preferences increases the effect of past consumption on a consumer's present consumption (reinforcement), but reduces the effects of future consumption on current consumption (tolerance).

The other coefficients estimated are statistically significant at all common level and carry the right "sign". In particular, the coefficient on price is negative and significantly different from zero. The coefficient on income variable, *inc*, shows a positive and significant impact on consumption. However, the model specification estimated don't allow us to compute the long-run relationship between disposable income and current consumption, so that nothing could be told about the nature of luxury good of cinema. The coefficient of screen variable, *scr*, exhibits a positive and significant impact on present admission, leading to the conclusion that the change in distribution during nineties, with the introduction of multiplex, has effectively contributed to interrupted and partially

[6] Differencing produces the disturbance term $u_{i,t} - u_{i,t-1} - \rho(u_{i,t-1} - u_{i,t-2})$ which displays second-order serial correlation. Given this type of serial correlation, $y_{i,t-2}$ is not valid as an instrument since it will be correlated with $u_{i,t-2}$ in the differenced disturbance term.

[7] The statistic is the difference between the Sargan statistic computed using the instruments tested in the set of exogenous instruments (restricted model) and the Sargan statistic computed excluding the variable checked from the set of instruments (unrestricted model). The results, together with a complete list of instruments are reported in Appendix.

reversed the negative trend in demand. Finally, also the estimates on movie production variable, *mov*, shows a positive impact on cinema demand.

The estimates of table 4 have been used to compute the two characteristic roots of equation (7) and the relative short-run and long-run response to a permanent price change. Short-run elasticity, measured in terms of sample means, is –0.55; while the long-run price elasticity is -2.12, a value that exceeds the short-run elasticity approximately four times. This result is consistent with Becker and Murphy's rational addiction theory. In fact, long-run effect of permanent price change exceeds the short-run response if and only if $\lambda_2 > 1$, which is equivalent to having $\theta_l > 0$ (Becker et al., 1994).

6. Conclusion

The objective of this paper was to assess whether cinema consumption may be defined as a rational addicted behaviour. We depart from previous studies on cinema consumption as we focus on a state-disaggregated model by applying dynamic panel data analysis to control for all time-invariant variables or state-invariant variables, whose omission could bias the estimates in a typical cross-section or time-series study. To this aim, a sample of cross-sectional and time series observations covering thirteen European countries over the period 1989-2002 has been used. The generalised method of moments estimates strongly suggest that cinema consumption conforms to a rational addiction hypothesis. Furthermore, other variables included in the regression have resulted significant in explaining the demand for cinema. The present result confirms previous researches extending evidence of the rational addicted behaviour to European countries.

To sum up, this paper provides empirical support to rational addiction model in that cinema consumption depends on past and future consumption. The future extension of this study will explore the rational addicted behavior to include two goods, cinema and television.

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Table 1. Definition of the variable used in the study

Variable	Mean	Std.Dev.	MIN	MAX
adm	1.9569	0.5700	0.8912	3.48
pri	6.0405	0.8954	4.0618	8.7556
inc	24433.82	5535.534	12125.05	39600
scr	7.6496	4.5504	0.9497	17.2691
mov	48.0439	46.5208	0	204

Table 2. F-tests for pooling the data

Variable	F-test
Test for pooling[1]:	
$DYpri_{i,t}$	0.54
$DYinc_{i,t}$	0.19
$DYscr_{i,t}$	0.14
$DYmov_{i,t}$	0.12
DY	0.23

Notes: For testing the hypothesis of pooling the following augmented models have been estimated:

$$adm_{i,t} = \beta_0 + \beta_1 pri_{i,t} + \Sigma\beta_{1i} Dpri_{i,t} + \beta_2 inc_{i,t} + \Sigma\beta_{2i} Dinc_{i,t} + \beta_3 scr_{i,t} + \Sigma\beta_{3i} Dscr_{i,t} + \beta_4 mov_{i,t} + \Sigma\beta_{4i} Dmov_{i,t} + \varepsilon_{i,t},$$

by adding T-1 year dummy for each variable that take the value 1 if observation belongs to the year considered. The F test is performed on the coefficient of these variables.

Table 3. Im-Pesaran-Shin test for unit roots

Variable	t-bar	p-value	Trend
adm	-2.307	0.307	Yes
pri	-1.838	0.887	Yes
inc	-2.287	0.333	Yes
scr	-1.738	0.942	Yes
mov	-1.897	0.839	Yes
Δadm	-4.309	0.000	Yes
Δpri	-3.265	0.000	Yes
Δinc	-2.377	0.095	Yes
Δscr	-2.083	0.019	Yes
Δmov	-3.612	0.000	Yes

Notes: The Im-Pesaran-Shin test involves the null hypothesis that each series has a unit roots against the alternative hypothesis that the series have different persistence. The null hypothesis is tested using the average of the t-ratios for each time series. Δ is the first difference operator.

Table 4. Rational addiction model

Variables	Estimated coefficient	Standard Error
adm(t-1)	0,5505*	0,1770
adm(t+1)	0,3483**	0,1441
pri	-0,0695*	0,0245
inc	0,0000653***	0,0000363
scr	0,1094*	0,0418
mov	0,0052*	0,0011
R^2	0,5513	
Sargan test	22,473	
Arellano and Bond residual test		p-value
AR(1)[A]	-2,37	0,0180
AR(2)[B]	0,98	0,3289
λ_1	0,4698	
λ_2	1,3466	
η_s	-0,545789	
η_l	-2,120481	

Notes: Instruments used are 3 lagged and 2 led levels of both explanatory variables and dependent variable. Regression includes *T*-1 time and *N*-1 country dummy variables but their estimates are non reported to save space. Arellano and Bond (1991) residual tests are performed on the null hypothesis of zero auto-covariance in residual (of order 1[A] e 2[B]).
*/**/*** indicates significance at 0.01/0.05/0.10, respectively.

Appendix. Instruments validity

Instruments	C-stat	P-value
adm(t-3)	0.222	0.63749
adm (t-4)	1.587	0.20782
adm (t-5)	0.356	0.55092
adm (t+3)	2.474	0.11572
adm (t+4)	1.568	0.21049
pri(t-3)	3.054	0.08055
pri(t-4)	0.206	0.64964
pri(t-5)	0.672	0.41242
pri(t+3)	1.101	0.29394
pri(t+4)	1.164	0.28065
inc(t-3)	1.576	0.20934
inc(t-4)	0.312	0.57632
inc(t-5)	0.098	0.75402
inc(t+3)	0.131	0.71714
inc(t+4)	0.635	0.42566
scr(t-3)	0.911	0.33982
scr(t-4)	1.327	0.24932
scr(t-5)	0.174	0.67662
scr(t+3)	0.159	0.68964
scr(t+4)	0.636	0.42534
mov(t-3)	1.275	0.25890
mov(t-4)	0.164	0.68551
mov(t-5)	0.467	0.49420
mov(t+3)	4.621	0.03159
mov(t+4)	0.833	0.36142

Notes: The C test involves the null hypothesis of exogeneity of each instruments tested. The statistic is computed as the difference between the Sargan statistic computed using the instruments tested in the set of exogenous instruments (restricted model) and the Sargan statistic computed excluding the variable checked from the set of instruments (unrestricted model). Under the null of exogeneity of instrument, C-statistic has a chi-sq. distribution with degree of freedom equal to the difference of the two Sargan statistics.

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