Dynamic Analysis of Alcohol Consumption: Feminization and Passive Drinking in Italy

Federico Perali and D. Aristei, L. Piccoli and L. Pieroni
University of Verona

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Motivation

- **“Feminization”**: an increasing number of women is consuming an increasing level of alcoholic beverages

- **“Passive Drinking”**: the presence in the household of a member addicted to alcohol affects the intra-household distribution of monetary and time resources and the welfare levels of all members
Feminization

Women are physiologically more exposed to the toxic effects of alcohol because of the lower metabolism of alcoholic beverages: the enzymatic endowment of ADH is half of men’s endowment

- Addiction to alcohol among Italian women is larger among retired women and housewives
- Since 1995 the number of young women (<24 years) consuming wine has increased at an annual average of 5%
- The number of women consuming more than ½ liter a day has increased by 8.7% since 1995 compared to -19% for men
- In the same period, the off-meals consumption of alcoholic beverages by women has increased by 22% (male consumption was stable). Among young girls (14-17), the consumption has increased by 100%.
Passive Drinking

- Alcohol is both a private and a public bad. It harms the user, and those surrounding him, including the unborn child, children, and family members who are often victims of the addicted violence. Drunk driving is another example. In analogy to the passive effects of smoking, we term these externalities as passive effects of drinking.

- The passive effects influence the family organization and the rule governing the intra-household allocation of resources and power, and each members’ welfare levels, especially those of the wife and children. When a father “drinks his pay,” little is left for the wife and children especially when he is the breadwinner.
Drinking Habits (1)

Do men and women have different drinking habits?
Are men more likely to develop addiction than women?

- The Habit formation process is influenced by a number of economic variables and by other exogenous factors such as demographic characteristics and psychological conditions.

- Habits arise when past and current consumption are positively related.

- Habit formation process, if it last over time, leads to a state of dependence.
Key information to understand the problem

- **Feminization**: Subjective rate of time preference for males and females. Do they differ?

- **Passive Drinking**: The sharing rule governing the distribution of resources within the household. Does it differ significantly across high and moderate drinking households?
 Fundamental questions, but ....

- Do the available data in Italy help?

- Not much ...

- Data on individual consumption of alcoholic beverages is available (in range form) in a series of time use surveys, not in the national consumption survey
Does the Theory Help?

- **Dynamic Theory** of consumption to learn something about the behavior of subjective rates of preference at the core of the feminization problem

- The **Collective Theory of the Household** to learn something about the intra-household allocation process at the core of the “passive drinking” problem
Dynamic Theory (1)

- We analyze the behavior of the representative agent, but would like to differentiate it by gender.

- We model the endogenous discount rate as depending on the level of habits and on information about the heterogeneity of individuals.
Habits or Heterogeneity?

- The rate of time preference is a subjective indicator of impatience representing the desire of an agent to anticipate and enjoy the benefits stemming from higher current consumption.

- The objective is to consider the rate of time preference as endogenous and depending on heterogeneous characteristics of individuals.

- By so doing we distinguish between myopic and forward-looking individuals.
Dynamic Theory (2)

- We model the habit formation process as a weighted average of past consumption levels

\[ z_t = \sigma e^{-\sigma t} \int_{-\infty}^{t} e^{\sigma s} c_s \, ds \quad \text{with} \quad \sigma \geq 0 \]

where \( \sigma \) rate of habits adjustment.

The program is

\[
\max_{c_t} \quad U(C_0) = \int_0^\infty u(c_t) e^{-\Theta_t} e^{-rt} \, dt
\]

\[
\Theta_t = \int_0^t [\rho(z_s) - r] \, ds \quad \text{discount rate.}
\]

s.t.

\[
\dot{a}_t = ra_t - c_t \quad \text{budget}
\]

\[
\dot{\Theta}_t = \rho(z_t) - r \quad \text{subjective discount rate}
\]

\[
\dot{z}_t = \sigma(c_t - z_t) \quad \text{stock of habits}
\]
Dynamic Theory (3)

- The Euler Equation for the program is

\[ r = \theta(c_t, \varphi_t, \sigma) - \frac{1}{\eta(c_t, \varphi_t, \sigma) c_t} \dot{c}_t \]

With the Rate of Time Preference is equal to

\[ \theta(c_t, \varphi_t, \sigma) = 1 + \left[ \frac{\varphi_t - u(c_t)/\rho(z_t)}{u'(c_t) - \varphi_t \rho'(z_t) \xi(\sigma) \sigma} \right] \rho'(z_t) \xi(\sigma) \sigma \]

- And the Elasticity of substitution is

\[ \eta(c_t, \varphi_t, \sigma) = -\left[ \frac{u'(c_t) - \varphi_t \rho'(c_t) \xi(\sigma) \sigma}{u''(c_t)} \right] \frac{1}{c_t} \]
Dynamic Theory (4)

- Our general rate of time preference describes a subjective preference structure that links the past, present and future consumption incorporating:
  - the memory of past events by the rate of habits adjustment $\sigma$
  - the perception of present events by the current consumption level $c_t$
  - the anticipation of future events by the present-value of future utilities, $\phi_t$.

- The analytical properties of the rate of time preference allow us to describe the dynamic evolution of an agent from a condition of potential habit to a state of addiction:

\[
\begin{align*}
\frac{\partial \rho(c_t, \phi_t, \sigma)}{\partial \phi_t} &> 0 \quad \text{increasing respect to the present value of future utilities } \phi_t \\
\frac{\partial \rho(c_t, \phi_t, \sigma)}{\partial c_t} &< 0 \quad \text{decreasing respect to current consumption } c_t \\
\frac{\partial \rho(c_t, \phi_t, \sigma)}{\partial \sigma} &> 0 \quad \text{increasing respect to rate of habits adjustment } \sigma
\end{align*}
\]
Consider the case of the myopic and forward-looking agent: heterogeneity is described by the two rates of habits adjustment $\sigma(dm) > \sigma(df)$ and whose values depend on demographic characteristics of the two agents.

- the propensity to exchange current for future consumption becomes increasingly less important.
- the myopic agent reveals an increasing impatience since his stock of habits with respect to the addicted good is higher.

Figure 1 - Rate of Time Preference of a Forward-looking and Myopic Agent
The subjective rate of time preference of the myopic agent incorporates reinforcement and tolerance, two behavioural factors that are closely related to the concept of adjacent complementarity.

The analysis clearly reveals a patience-dependence trade-off:

- a patient person has a lower stock of habits than an impatient person, since the desire to anticipate future consumption is lower.
- addiction is more likely to arise for people who discount the future heavily since they pay less attention to the adverse consequences.
The dynamic analysis of addiction proposed by the model is characterized by the following behavioural properties:

- an increase in the stock of habits induces an increase in the degree of impatience. We described the behavioural dynamics of an agent who evolves from a habit to a state of addiction using a patience-dependence trade-off. A patient agent is forward-looking valuing the future more than a myopic agent, whose level of habits is higher than the first one, because he is less worried about the consequences of an excessive current consumption.

- the higher is the incidence of past consumption on current consumption choices, the lower are the values assumed by the endogenous elasticity of intertemporal substitution as well the lower is the agent's propensity to exchange current for future consumption.

- the heterogenous structure of habits allows us to explain how an increase in the rate of return to savings makes the forward-looking agent more forward-looking than the myopic consumer.
The Collective Theory
The Edgeworth’s Box and the cooperative Nash solution

\[ W = (U_f - V_f) \alpha (U_m - V_m) \beta \]
Informational Requirements to Implement a Collective Approach

- **I. At least one exclusive good**
  - (individual consumption that can be observed also within households – Chiappori’s collective approach)

- **II. The consumption of male and female individuals living alone. AND. the household technology** (Lewbel, Browning, Chiappori 2003)

- *We follow I.*
The Collective Consumption Approach

\[ \max U^i(e^i, o) \]

\[ \text{s.t.} \quad p_i e^i + o \leq \phi^i(p_a, p_c, y_a, y_c, y_o) \]

\[ e^i \geq 0, \quad o > 0, \]

\( \phi \) is the sharing rule governing the intra-household allocation of resources. The existence of the sharing rule implies that we can recover individual consumptions \( \ldots \) if we model it \( \ldots \) corner solution are important as well at the level of detail of private goods.
A Collective Quadratic Almost Ideal Demand System

\[ w_i = a_i + \tau_i(d) + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \]

\[ + \beta_i^a \left( \ln Y_m^* - \ln A(p, d) \right) + \frac{\lambda_i^a}{B(p, d)} \left( \ln Y_m^* - \ln A(p, d) \right)^2 \]

\[ + \beta_i^c \left( \ln Y_f^* - \ln A(p, d) \right) + \frac{\lambda_i^c}{B(p, d)} \left( \ln Y_f^* - \ln A(p, d) \right)^2 \]

\[ \ln Y^{*} = \phi^a - \ln P^{*a} \]

\[ \phi^n = w_m \ln Y + \ln m^m(p, z) = \ln Y_m + \ln m^m(p, z) \]
The Research Program

Theory: Dynamic & Collective
1. Euler specification and behavioral hypotheses
2. Sharing rule

Collective Consumption
(micro)

Collective Model Estimation:
Intra-household distribution of resources

Dynamic Consumption
(macro)

Euler Equation Estimation:
Separate rate of time preference for male and female using
cohort data
pseudo-panel data

Theory and Micro-simulations
Optimal Taxation
Data

- The data sets used in the analysis is the series of ISTAT Household Expenditure Survey (1997-2002) where unit values have been added in order to undertake a complete demand and welfare analysis.

- But no information about individual consumption of alcoholic beverages is available, so we plan to match the data with the individual specific information coming from the ISTAT Multipurpose Survey (1996-2002).
Data Preparation

To meet our objectives, we work with 3 types of data sets:

1. A series of cross-section expenditure surveys with unit values added. We plan to match these surveys with information on individual consumption of alcoholic beverages from the ISTAT Multipurpose Survey.

2. Cohort dataset consisting of a series of repeated cross-sections for the period 1997-2003 obtained by grouping the households into 12 five-years cohorts on the basis of the head’s year of birth.

3. We intend to construct also a pseudo-panel data set using the cross-section series.
Dynamic Consumption

- Preliminary analysis in preparation of the estimation of a Euler equation using both cohort data and the pseudo-panel.

- Our objective is to maintain at the aggregate level the differentiation between male and female consumption in order to estimate the associated subjective rates of time preferences.
Cohort Analysis (1)

Average expenditure on alcoholic beverages by age and cohort

[Graph showing average expenditure on alcoholic beverages by age and cohort for male and female headed households.]
Our aim is to evaluate the determinants of household expenditures on alcoholic beverages, assessing the effects that economic, demographic and social factors may exert on alcohol demand. Further, we model the structure of generational and age effects by including a linear cohort-age-time decomposition of alcohol expenditure in an extended double hurdle model. To this end we express observed alcohol consumption as a function of household’s head age and birth-year cohort and of two set of socio-demographic and economic variables which are assumed to separately affect alcohol participation and consumption decisions:

\[
\ln c = F(z, x) + \alpha_c D^a + \gamma_c D^b + \varphi_c D^{a+b} + u_c
\]
Cohort Analysis (3)

- To deepen the investigation of the observed heterogeneity in alcohol consumption, we disaggregate the analysis according to the gender of the household’s head and to the geographical distribution of the families.

*Wald tests of joint significance of age and cohort effects*

<table>
<thead>
<tr>
<th>Equation</th>
<th>Male-headed households</th>
<th>Female-headed households</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cohort Effect</td>
<td>Age Effect</td>
</tr>
<tr>
<td>Participation</td>
<td>( \chi^2_{(11)} = 30.32 )</td>
<td>( \chi^2_{(12)} = 54.22 )</td>
</tr>
<tr>
<td></td>
<td>( p\text{-value} = 0.001 )</td>
<td>( p\text{-value} = 0.000 )</td>
</tr>
<tr>
<td>Consumption</td>
<td>( \chi^2_{(11)} = 65.05 )</td>
<td>( \chi^2_{(12)} = 31.96 )</td>
</tr>
<tr>
<td></td>
<td>( p\text{-value} = 0.000 )</td>
<td>( p\text{-value} = 0.002 )</td>
</tr>
</tbody>
</table>

- A disaggregated analysis is particularly interesting for comparing the different patterns of generational and age effects on alcohol consumption decisions of male and female-headed households.
Cohort Analysis (3)

Cohort, age and year decomposition of alcohol consumption by gender from a double-hurdle

Male-headed Households

Cohort Effect

Age Effect

Female-headed Households

Cohort Effect

Age Effect
Is the information in the data about individual consumption (clothing for males/females/children) sufficient to identify the sharing rule and the presence of possible passive effects?
Child and Gender Effects on the Consumption of Alcoholic Beverages

- The presence of children is associated with lower consumption of alcoholic beverages especially when young children are present at each level of total expenditure.

- Males headed households have a larger share of alcoholic beverages at low levels of total expenditure.
Can individual expenditures on clothing tell us something about differences in the sharing rule of heavy and moderate drinking households?

- female clothing expenditure shares are lower in heavy drinking households
- education and recreation expenditure shares (for children) are lower in heavy drinking households especially for high levels of income
Looking for Robust Effects

The table shows the impact of some demographic characteristics of interest on the Engel Curve for alcoholic beverages estimated using a semi-parametric regression.*

Note the negative effects associated with the gender of the household head (female) and the working status of both husband and wife.

Being a smoker is strongly associated with the consumption of alcoholic beverages.

Age is also positively related.

<table>
<thead>
<tr>
<th></th>
<th>coef.</th>
<th>s.e.</th>
<th>t ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>intercept</td>
<td>0.0305</td>
<td>0.01184</td>
<td>2.5750</td>
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<tr>
<td>gender</td>
<td>-0.0051</td>
<td>0.00029</td>
<td>17.4500</td>
</tr>
<tr>
<td>smoke</td>
<td>0.0026</td>
<td>0.00024</td>
<td>10.8200</td>
</tr>
<tr>
<td>husband works</td>
<td>-0.0016</td>
<td>0.00032</td>
<td>5.1640</td>
</tr>
<tr>
<td>wife works</td>
<td>-0.0019</td>
<td>0.00028</td>
<td>7.0770</td>
</tr>
<tr>
<td>Living in low-class areas</td>
<td>-0.0003</td>
<td>0.00024</td>
<td>1.4070</td>
</tr>
<tr>
<td>december</td>
<td>0.0033</td>
<td>0.00040</td>
<td>8.3110</td>
</tr>
<tr>
<td>elderly</td>
<td>0.0016</td>
<td>0.00039</td>
<td>4.1300</td>
</tr>
</tbody>
</table>

* $w_i = X\beta + f(\ln y)$
Estimates of the Sharing Rule

Sharing Rule Strong Drinkers

Ln of Total Expenditure

Reduced Sample Scatter Plot  Strong Drinkers
Astemious  0.5 line
The sharing rule: an interesting policy object
Next in the Research Program

- Gender specific demand for alcoholic beverages via matching
- Estimation of gender specific subjective rates of time preference
  \[\textit{in order to}\]
- Run theory simulations
- Run micro simulations
- And to investigate the relevance of government intervention associated with the presence of intra-household passive effects generated by a more egoistic pattern of resource distribution and possible forms of despotism induced by alcohol consumption by implementing optimal taxation of “bads” at the individual level
If you are interested to follow our progress in the research program, please monitor the project site...

http://pilar.univr.it/alcohol

Thank you