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by **Daniela Del Boca**
and
Annamaria Lusardi

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C.V. STARR CENTER FOR APPLIED ECONOMICS

NEW YORK UNIVERSITY
FACULTY OF ARTS AND SCIENCE
DEPARTMENT OF ECONOMICS
WASHINGTON SQUARE
NEW YORK, NY 10003-6687

DEBT COMMITMENT, HOUSING AND FAMILY ALLOCATION OF TIME

Daniela Del Boca
University of Turin and NYU

Annamaria Lusardi
Dartmouth College and ICER

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Abstract

In this paper, we analyze the interrelationship between housing financing decisions and family allocation of time using Italian data. We investigate whether mortgage commitments as well as other debts are related to wives' labor supply decisions. We address the issue of endogeneity by using simultaneous equations models.

In analyzing the effect of housing financing on family labor supply, it is important to consider some institutional factors. The most notable characteristics of the Italian housing market are the high down-payment requirements, short mortgage duration, and slow loan application process. We test whether wives' labor supply is responsive to mortgage debts (relative to other debts) and whether the recent changes towards flexibility in the financial market may be in part responsible for the increase in married women's labor supply among homeowners.

Keywords: Labour Supply, Housing, Credit Constraints.
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1. Introduction

Many studies have documented the effects of imperfections in the financial markets on consumption and saving decisions (Zeldes 1989, Browning and Lusardi (1996)). One of the most important market for consumer credit is the mortgage market and there are a number of works that show how imperfections in this market have effects on household decisions (Engelhardt 1996).

In this paper we argue that imperfections in the mortgage market can spill over to other markets, in particular to the labor market. We will show that mortgage debt more than any other type of debt has an important impact on the labor market decisions of homeowners. We analyze the relationship between financing decisions and family allocation of time using Italian data. We investigate whether mortgage commitments as well as other debts are related to wives' labor supply decisions. We examine the case of a country that experienced a very high degree of imperfections in the mortgage market, but underwent substantial changes due to the financial liberalization brought by the European unification. We therefore have a unique laboratory to study the effects of the financial markets on the labor market.

In Italy, the financial markets have been highly imperfect in comparison with other industrialized countries and the terms of consumer credit to households are still very unfavorable. In analyzing the housing financing decision, it is important to consider some institutional factors that differentiate Italy from other advanced countries. Some important characteristics concern the Italian housing market: the average downpayment is extremely high relatively to other countries, the duration of mortgage is very short, while transaction and legal costs are higher in Italy than in most advanced countries. Consequently the mortgage market is relatively small.

Another important aspect concerns the labor market. While in most advanced countries the proportion of part-time employees is between 20-30 of the total work force, in Italy is about 5-6 percent and it has not increased in recent years. Therefore the choice of hours of work for Italian workers is basically a binary one: zero or forty hours a week. Given the scarcity of part-time jobs, the employment rate of Italian women is lower than other countries: only about 33 per cent of the working population against an average of 45 percent

in EU countries.

In spite of mortgage and labor market imperfections, the number of Italian households who are homeowners is higher than in most other countries. The overall home ownership rate rose from 46 percent in 1961 to 59 per cent in 1981 and grew to 75 per cent in 1995. Studies which focus on the Italian housing market have shown that borrowing constraints have not prevented households from becoming home-owners partially because until recently there was no alternative to owning, because of the imperfections and regulations of the rental market for housing. Other studies have explained the high homeownership rate by the bequest motive, the low cost of higher education, the stability of the Italian family and the very low geographic mobility rate.

Recent studies which have analyzed the way in which families modify their behavior in order to facilitate savings have incorporated important features of the institutional setting (Yoshikawa and Ohtake (1989), Fortin (1995)). In this paper, we argue that Italian households overcome financial market limitations by increasing family labor supply. As a consequence, the optimal leisure choices may depend not only on the household's marginal utility of wealth and on the spouses' respective wages, but also on the debt commitment.

The data we have used in this research has the potential to be especially useful in determining the importance of mortgage debt commitment in the family's decision regarding the labor market participation of the wife. We do utilize a two cross-sectional data sets, one collected in 1989 and the other in 1993. Between these two date, there was a change in the law regulating the structure of mortgages. Perhaps the most important aspect of this change was to increase the percentage of the total purchase price which could be financed through a mortgage. We note that between these two dates the percentage of homeowners with a mortgage increased markedly, rising from 16 to 28 percent. At the same time, the percentage of wives who work increases from 43 to 48 percent in the sample of homeowners.

One objective of our analysis will be to determine how much of the increase in the participation rates of these married women can be attributed to increases in the utilization of mortgages in the population of homeowners.

One attractive way to visualize the [short-run] effect that the change in financial market regulations has on mortgage usage and wives' participation

rates is through the latent variable simultaneous equation models first formulated by Heckman (1978). In this structure we think of the "propensity" for the wife to participate in the market and the propensity for the [home-owning] family to hold a mortgage as latent variables. The values of the latent variables themselves are not directly observed; instead only an indicator variable is observed if the value of each exceeds a certain threshold which is particular to the variable considered. One can think of these variables as being jointly determined within a simultaneous equation system, though it may be reasonable to expect that there is no significant direct feedback from the propensity for the wife to participate in the market to the propensity for the household to have a mortgage.

We think of the changes in mortgage regulations as effectively serving to lower the threshold which maps the propensity to have a mortgage into actually holding one. If our hypothesis is correct, changes in the law will shift the intercept term only in the mortgage equation without altering any other characteristic of the structural model. In particular, we will look for evidence that there was no exogenous shift in the labor force participation equation.

The structure of the paper is as follows. In Section 2 we describe the main characteristics of the Italian mortgage market. Section 3 contains the theoretical framework. Section 4 reports a description of the data sets we use. Section 5 describes the econometric specification of the models. Section 6 reports the empirical estimates and Section 7 provides some concluding remarks.

2. The Mortgage Market

In this section we consider some institutional factors that differentiate Italy from other advanced countries. A first important characteristic of the Italian financial market is the extremely small size of the mortgage market. Several factors account for mortgage market imperfections in Italy: regulations requiring high minimum down payments, limited competition between financial intermediaries, and transaction and legal costs caused by a highly rigid and bureaucratic system.

Table 1 reports some comparisons between the Italian mortgage market and those of other European countries and the US.

TABLE 1

Countries	Mortgage/ house value	Duration of mortgage loans	Mortgages/GNP
Italy	50	10	6.0
Germany	60-80	12-30	40.0
Great Britain	75-100	25	57.0
France	80	10-20	24.0
US	80-90	25-30	60.0

Source: European Mortgage Federation "Annual Report 1993-1994".

The percentage of mortgage loans as a proportion of the house value is about fifty per cent of the house value, which is much lower than in other developed countries. The ratio of mortgages on GNP is only six per cent in Italy, again a very low value in comparison with other selected countries.

An important feature of the mortgage market is the short duration of loans. While in the US the average duration is between 25-30 years, in Italy it is only ten years. Because of the relative reduction of the duration of the mortgage (duration was longer in the sixties, but it shortened considerably after the period of high inflation in the seventies [due to the lack of indexed contracts] and it has remained low in the eighties), the increase in the interest rate and in housing prices (the price of the house as multiple of family income has increased from 4.5 to 6.7) it seems that the burden of the mortgage has shifted from the accumulation for the down-payment to the re-payment of the mortgage debt. Recent research (Villosio 1995) shows that between 1975 and 1993 the incidence of first installment on family income has increased from 27% to 52%, making it very difficult for one-earner family or middle-income families to afford to buy a house and re-pay the mortgage.

Another important characteristic of the mortgage market concerns the costs of transactions, which include the charges of real estate agents and taxes. While in Great Britain the cost of transactions is about 4.5 percent of the house value, in Germany 12 percent, in France 16 percent and in

Italy 18 per cent. This higher cost is associated with a relatively higher tenure duration: while in Great Britain the average duration is 7 years, in Germany 28 years and Italy 50 years.

While in countries like the US, Canada, and the UK, loan applications are processed rapidly because specialized credit reference agencies are able to provide information on the credit record of most potential borrowers, in Italy the process is much slower and bureaucratic. A recent report of the Bank of Italy shows that part of the high transaction costs is associated with the complicated process of repossessing collateral (Generale and Gobbi 1995). It takes 5.5 years on average for a bank to repossess the collateral (4.5 in North and 6.6 in the South). This difference is consistent with the empirical evidence indicating a lower percentage of mortgage holders in the South that we report in Section 4.

In recent years some liberalization of the financial market has occurred (Miles 1992). Since 1992, foreign banks (especially British) have started offering alternative borrowing possibilities and more competitive mortgage conditions to Italian families than they had in the past. We will exploit these variations in the financial markets in our empirical work to attempt to determine whether changes in the financial market have spillover effects on the labor markets.

3. Theoretical Framework

We consider here a simple model of household's choice of consumption and leisure. The household is assumed to maximize an additively-separable utility function:

$$1) \qquad \max E \sum_{\tau=t}^{N} \frac{1}{(1+\beta)^{\tau-t}} [U(C_\tau) + V(L_\tau)]$$

subject to the following constraints:

$$2) \qquad A_\tau = (1+r)A_{\tau-1} + M_\tau + w_\tau(T-L_\tau) - p_\tau C_\tau$$

$$3) \qquad A_\tau \geq \phi_0$$

$$4) \qquad T - L_\tau \geq 0 \qquad \tau=t,\ldots,N-1$$

A_{t-1} given and $A_N = 0$

where:

C is consumption

L is leisure

M is other (non- capital) income

A is non-human wealth

p is the price of consumption

w indicates wages

r is the interest rate which is assumed to be fixed

β is the rate of time preference

N indicates the terminal period

The maximization is subject not only to a budget and non-negative labor supply constraint (equations 2 and 4 respectively), but also to a borrowing constraint represented by equation 3. In this specification we capture the fact that household borrowing cannot go beyond a certain limit.

The first order conditions are:

5) $$U_c(C_t) = \lambda_t p_t$$

6) $$V_l(L_t) = \lambda_t w_t + \nu_t$$

7) $$E_t\left[\frac{\lambda_{t+1}(1+r)}{(1+\beta)}\right] = \lambda_t - \mu_t$$

8) $$\mu_t(A_t - \phi_0) = 0$$

9) $$\nu_t(T - L_t) = 0$$

where λ denotes the Lagrange multiplier associated with the budgetconstraint, whereas μ and ν are the Kuhn-Tucker multipliers associated with the borrowing and the time constraint (equations 3 and 4). U_c and V_l denote the first derivative of the utility function with respect to consumption and leisure respectively.

Only in the case in which there are no constraints and we are not at a corner solution for labor do we get the solution that the allocation corresponds to the points where the marginal rate of substitution between

consumption and leisure corresponds to the ratio of prices. The fact than an additional unit of labor can decrease the probability of a binding constraint introduces a wedge between the marginal rate of substitution and the ratio of prices:

$$10) \qquad \frac{V_l}{w_t} \geq \frac{U_c}{p_t} + \frac{\nu_t}{w_t}$$

From simple substitutions we obtain:

$$11) \qquad E_t\left[\frac{U_c(C_{t+1})(1+r)}{p_{t+1}(1+\beta)}\right] = \frac{U_c(C_t)}{p_t} - \mu_t$$

$$12) \qquad E_t\left[\frac{U_c(C_{t+1})(1+r)}{p_{t+1}(1+\beta)}\right] = \frac{V_l(L_t)}{w_t} - \mu_t - \frac{\nu_t}{w_t}$$

Ceteris paribus, constrained households will consume less than unconstrained households (since $\mu_t > 0$, the marginal utility of consumption today is greater than the present discounted value of consumption tomorrow, which means that consumption today is lower than in the unconstrained case). We can also see that, ceteris paribus, constrained households will work more than unconstrained ones (the marginal utility of leisure today is greater than the present discounted value of consumption tomorrow, which means that with respect to the unconstrained case, i.e. $\mu_t = 0$, the consumer is having less leisure).

Families who have a mortgage are more likely to be close to the binding limit, and are more likely to modify labor supply. We should therefore see, in particular, women working more (given that husbands' labor supply is not very flexible) in order to increase family earnings and make the constraint less binding.

In the empirical work, we model the female labor market participation not only as a function of variables that can proxy for female wages and the current and future household resources, but also as a function of variables proxying for the burden of the mortgage commitment.

4. The Data

The data are from the Bank of Italy's Survey of Household Income and Wealth (SHIW) in 1993 and 1989. We have selected married couples, in the age range 21-59 (for men) and 21-55 (for women), in order to exclude individuals who are in school or who are retiring. Other selection criteria are described in Table A.1 in Appendix 1.

The percentage of households with a mortgage is 28 per cent in the total and 34.7 per cent in the sample of homeowners who bought the house, i.e. those owners who did not receive the house as a gift or bequest. The proportion of households who bought the house and have mortgage debt is much higher in the North-Center of Italy (33.4) than in the South (24.8), which seems consistent with the empirical evidence of the lower transaction costs in the North. The survey provides information on the residual mortgage debt. The conditional mean and median of mortgage debt are respectively 35.1 millions and 25 millions of liras. Households borrow not only from the bank but also from the network of the extended family. Conditional means and median of family loans are 14.5 and 9 million liras, respectively. While households report owing other debts, their total amount is lower than the residual mortgage debt. The mean and median of other debts are 7.2 and 5 millions.

Table 2 reports the descriptive statistics of husbands and wives' characteristics by different financing situations. The critical point that emerges is that, among homeowners, the participation rate of women is very different across housing financing modes: women's participation rate is 50 percent among the homeowners who bought the house but do not have a mortgage debt and 42.7 per cent among the homeowners who received the house as a gift or bequest. Among the homeowners who bought the house and have a mortgage the participation rate is instead 58.9 per cent. Households who financed house purchasing with a mortgage are also those where both husbands and wives are younger and have higher education, are more likely to live in the Northern regions and to work more hours.

Table 3 shows the age patterns of labor market participation rates of wives who live in households with a mortgage and those who do not.

TABLE 3

Labor Market Participation rates of Wives

Age	Homeowners	Homeowners with Mortgage
<30	45.8	61.2
30-35	49.6	55.7
35-40	58.5	66.2
41-45	53.8	63.5
46-50	43.2	48.9
51-55	29.6	39.8

Among households who have a mortgage debt the labor market participation rate is higher in all age brackets. The largest difference is for the age group 21-30 (almost sixteen points), but it remains quite large even in older age groups. While wives' participation rates for homeowners decrease quite markedly after 45, wives' participation rates for homeowners with mortgages remain quite high, about 49 per cent and 40 per cent in the age brackets of 46-50 and 51-55, respectively.

We will focus on the probability of women's participation in the labor market. It seems that the important decision is whether or not to participate in the labor market rather than how many hours to work. The hours distribution for both men and women in Italy is highly concentrated around 35-40 hours a week. Recent research on Italian labor supply (Colombino and Del Boca 1990) has shown that the interesting behavioral response occurs at the extensive margin rather than at the intensive one.

In the empirical work we will consider as exogenous determinants of the wife's probability of working and the mortgage debt the following sets of variables:

1. Personal Characteristics

We include in this set the wife's age, the wife's schooling, the husband's schooling, the number of children between 0 and 6 years of age, the household's income (residual income after the wife's labor earnings, expressed in 1993 million liras) and the region of residence (a dummy variable equal to 1 if they live in the North).

2. Family Background

Our data set provides information on the parents of the wife and husband. To control for unobserved heterogeneity we use family background characteristics. We use information concerning whether the wife's mother was working at the daughter's present age [to take into account her attitude towards work] and whether the husband's mother had worked [to take into account the husband's attitude towards his wife working].

3. Family economic contributions.

As we have mentioned before, the family also has a role in trying to compensate for the limited borrowing opportunities of the Italian mortgage market. We note that in in our sample 20 percent of homeowners did not directly buy the house but rather received it as a gift or a bequest. Another important variable describing the debts with relatives.

4. Other debts

The survey provides information on other household debt (for example, debts on cars, installment payments on household appliances etc.). We consider those debts as well in the empirical work. They allow us to examine whether the effect of the mortgage is different from other type of debt, as they could serve as indicators of attitudes towards debt.

5. The credit system

The survey reports data on the respondent's relationship with banks and on other variables that measure access to credit markets. For example, households are asked whether they have a checking account, how many banks they have been using, and how many years that have used the same bank. These variables can be useful for identifying different types of borrowers and also for picking up different degrees of asymmetric information that could affect bank lending.

5. Econometric Specification

Our empirical research focuses on the effect of mortgage debt commitment on labor market activities of married women and whether this effect is

different from other debts. We will analyze this effect conditional on various sets of socio-demographic variables describing personal characteristics, family background, family's contribution to household's resources, and variables describing the credit market system.

We will first use a static framework (using the 1993 cross-section) and then exploit the temporal variation, utilizing a two cross-sectional data sets, one collected in 1989 and the other in 1993. Between these two dates, there was a change in the law regulating the structure of mortgages and we exploit that variation to better identify the effects of mortgage market imperfections on labor supply.

In this section we discuss the models we have estimated which are based on a latent variable specification of the mortgage and participation decisions. It is well-known that the interpretation of the linear regression-type models is problematic when some or all dependent variables are binary, as is the case here. Latent variable models provide a useful framework within which to interpret the relationships between discrete random variables, at the cost of introducing some restrictions not present in the linear estimation case [particularly in the context of simultaneous equation systems].

We have estimated two special cases of the type of simultaneous equation model involving latent variables proposed by Heckman (1978). The general structure is

$$13) \qquad y^*_{1i} = X_{1i}\beta_1 + \delta_1 y^*_{2i} + \eta_1 y_{2i} + \varepsilon_{1i}$$

$$y^*_{2i} = X_{2i}\beta_2 + \delta_2 y^*_{1i} + \eta_2 y_{1i} + \varepsilon_{2i}$$

$$\text{where } \begin{pmatrix}\varepsilon_{1i}\\ \varepsilon_{2i}\end{pmatrix} \sim N\left(\begin{bmatrix}0\\ 0\end{bmatrix}, \begin{bmatrix}1 & \rho\\ \rho & 1\end{bmatrix}\right), \quad \forall\ i;$$

$$\text{and } y_{ki} = \begin{cases} 1 & \text{if } y^*_{ki} > 0 \\ 0 & \text{if } y^*_{ki} \leq 0 \end{cases}$$

where y_{1i} takes the value 1 if the wife in household i was participating in the labor market at the time of the interview and assumes the value 0 otherwise; y_{2i} takes the value 1 if household i currently has a mortgage on their

house; and X_{1i} and X_{2i} are vectors of exogenous variables in the participation and mortgage equations, respectively. The error term vector $\varepsilon_i \equiv (\varepsilon_{1i}\ \varepsilon_{2i})'$ The data available to estimate (13) consist of a random sample of observations on $\{y_{1i}, y_{2i}, X_{1i}, X_{2i}\}_{i=1}^{N}$. It is well-known [cf. Heckman, 1978] that such information is not sufficient to identify all the structural parameters which appear in 13.

A number of restrictions on the model are required first to ensure logical consistency [these are typically referred to as "coherency conditions"] and then to secure identification in the classical sense. We now provide some discussion of the two models estimated in this paper.

Model 1: $\delta_1 = \delta_2 = 0$
$\eta_2 = 0$
$\rho = 0$

Because the error terms are assumed to be uncorrelated [$\rho = 0$], there is no simultaneity in this specification of the model. Having a mortgage is assumed to affect the latent variable interpreted as the propensity to participate in the labor market, but labor market participation is assumed not to affect the propensity to have a mortgage. Since the error terms are uncorrelated, probit estimation of the first equation alone provides consistent and efficient estimates of η_1 and β_1 under the model assumptions.

Model 2: $\eta_1 = \eta_2 = 0$

This corresponds to the classic linear simultaneous equation model except for the fact that the dependent variables in the system are all latent. Identification conditions for this model are identical to those in the model for which the dependent variables are observable; in particular, in the absence of restrictions on the covariance matrix exclusion restrictions are required. In the specifications estimated, many more restrictions are imposed than are required for identification. In addition, a condition must be satisfied ["coherency"] for the model to be a well-defined probabilistic structure, namely $1 - \delta_1\delta_2 > 0$. This condition is not imposed in the estimation of the model but is checked at the model estimates to verify the unconstrained maximum likelihood estimator satisfies it. The ℓn likelihood

function for this model is reported in Appendix 2.

6. Empirical Results

In Table 4, we report the estimates of Model 1 for the entire sample of homeowners including and excluding homeowners who received their house as a gift or bequest, using two different indicators for the mortgage debt. The first is a dummy variable if the household has a mortgage debt(in column I and III), and the second is the mortgage amount still owed (column II and IV).

The schooling of the wife and husband is always positive and very significant, while the household income is always negative and significant. As expected, age of the wife and the number of children younger than six in the household decreases the probability of wives working. Living in the North significantly increases the probability of working. The measures of family background (indicating whether own mother and mother-in-law worked at the wife's age) are positive and significant and strongly affect the wife's probability of working.

Both the dummy indicating that the household has mortgage debt and the variable indicating the remaining mortgage value are positive and significant across specifications. Even after controlling for many variables that affect participation, we still find that having a mortgage has an effect on wives' participation. This finding is consistent with other empirical results reported by Fortin (1995). For homeowners who received their house as a gift or bequest [and thus never faced a financing decision], the wives' participation rate is even lower than among those homeowners who purchased their house without a mortgage.

We have introduced in the equation two different indicators for family debt (as for the mortgage debt) a dummy indicating whether the family has a debt with relatives, and the amount owed. The coefficients of the variables indicating family debts have the same sign as the mortgage debt on the wife's probability of working but are never significant. We have also included the other debt that the household has (as a dummy or as the remaining amount owed) to examine whether mortgage commitment is different than other types of debt. We find that the estimates of other debt (family

or other) are not statistically significant.

Table 5 contains estimates of the latent variable simultaneous equation model (Model 2). The latent propensity measures appear on the RHS in both equations-that is, we allow the system to be nonrecursive. The first point we address is the issue of simultaneity. Under the model structure, simultaneity exists if the correlation coefficient associated with the error terms is significantly different from zero. We see that the estimated correlation is -.251 with an associated [asymptotic] t-statistic of over approximately 15 [in absolute value]. Thus there is a strong indication of the presence of simultaneity. The negative correlation provides something of a challenge as far as interpretation is concerned. It could presumably result from the omission of a satisfactory wealth measure. High family wealth could act to increase the participation propensity of the wife (we see that education has also a positive effect) and reduce the desire to attain a mortgage. Thus this type of "wealth" effect would only be operative for families with intermediate levels of wealth, though such families might well comprise a large proportion of the total sample.

In terms of the coefficient estimates in the work propensity equations the signs accord to a large degree with expectations. The wife's schooling is an important determinant of the likelihood of working, as is whether she resides in the North of Italy. The background variables *mother work* and *mother-in-law work* are quite strong positive predictors of the likelihood of working. As mentioned earlier, we interpret these variables as largely reflecting household norms regarding the appropriateness of the wife's labor market participation, though they may also be indicators of household wealth. Most importantly, the presence of a mortgage is an incredibly strong inducement to work; recall that this effect is estimated allowing for simultaneity. The coefficient is .420 and the standard error is .077.

In the mortgage equation, the husband's schooling level is positively related with the likelihood of having a mortgage presumably due to its effect on the attractiveness of the applicant to a lender. The household's income has a negative effect on the propensity to have a mortgage, presumably because there is less of a need for financing housing purchases through a mortgage in this case. Having an association with a bank increases the likelihood of a mortgage probably because of increased contacts with financial institutions

which provide them. Finally, years of tenure with a bank increases the likelihood of acquiring a mortgage because they often provide better mortgage opportunities and reduce information asymmetries between banks and borrowers. The latent propensity measures appear on the RHS in both equations-that is, we allow the system to be nonrecursive.

Once again, there is strong evidence for the presence of simultaneity from the large, negative correlation between the structural disturbances. We note that while there is strong evidence for simultaneity, there is no strong evidence of non recursiveness. The propensity of the wife to work has a small positive direct effect on the mortgage propensity, but the estimated coefficient is not significantly different from zero. The coefficient of the wife work propensity in the mortgage equation is .091 with a .060 standard error. Conversely, the effect of the mortgage propensity on the participation propensity is positive and quite significant statistically. Thus these simultaneous equations specifications provide quite consistent representations of the relationships between these two dependent variables.

We now exploit temporal variation in the structure of the Italian mortgage market in order to better identify the effect of the mortgage on female labor market participation. As we have mentioned above, the year 1992 marked the beginning of a period of financial liberalization in Italy and in Europe. Not only was there free circulation of goods and services across the European countries, but also free movements of capital and free entrance of foreign banks across national borders. A few banks, in particular British banks, entered the Italian market, and the increased competition made domestic banks also more pressured to offer advantageous terms in mortgage contracts.

We have constructed a sample similar to the one of 1993 using the Bank of Italy Survey pre-1993 and, in particular, we choose the year 1989. Simple comparisons across years show the degree to which households have mortgage debt has been changing rapidly in the 4 year period. The mortgage rate among homeowners increase from 16 percent in 1989 to 28 percent in 1993, an increase of almost 15 percentage points. The female participation had a more modest increase over the period: it went from 43.7 in 1989 to 48.7 in 1993. Not only did the proportion of mortgages increase, but also the amount borrowed increase. Our data set reports information only on the residual mortgage debt and if we considered the households who bought the house in 1989

and 1988, their remaining mortgage debt is 30.65 millions. For the households who bought the house in 1993 or 1992 the remaining mortgage debt is 58.29 millions.

Table 6 reports the distribution of homeowners who bought the house with a mortgage across age groups. In the 1993 sample the proportion of homeowners who have a mortgage is much higher than in the 1989 sample. We note that the remarkable difference is among the younger age group (25 percentage points) who are the ones benefiting the most from the liberalization.

TABLE 6

DISTRIBUTION OF HOMEOWNERS WITH MORTGAGE ACROSS AGE GROUPS

Age of Head of Household	%Mortgage 1989	%Mortgage 1993
< 30	18.60	43.68
30-40	18.55	34.58
41-50	17.26	31.38
51-60	6.55	21.40

We first examine whether similar findings occur in 1989 with respect to 1993. Unfortunately, it is not possible to estimate exactly the same specification because of noncomparability of the survey instruments in the two years. We lack information on some of the financial variables (namely the variable indicating how many years the household has used the same bank) and the information about family background. Thus we have estimated a more limited specification. We first estimate a probit model on the 1989 sample and obtain similar results as for the 1993 sample; the coefficient of the mortgage is positive and statistically significant. We then pool the two cross-sections and estimate a probit on the pooled sample in Table 7.

Table 7 contains estimates of a probit model of the wife probability of working for the sample 1989-1993. We estimate the probability of working conditional on personal characteristics (age, age of children, region of residence, wife's schooling, husband's schooling) and variables describing the financial situation of the household (income, family debts, other debts) as well as a year dummy. All estimates of the variables related to personal

characteristics are very similar to the estimates of the 1993 sample. The estimates related to financial position of the household seem to be a little more significant in a temporal context, while the dummy for the year is *positive* but not significantly different from zero. The coefficient of the mortgage is positive and statistically different from zero, while the coefficients related to other debts are not significant and family debt has the opposite sign.

Table 8 reports the estimates of the latent variable model for the sample 1989-1993. We first note that the latent variable specification [i.e., Model 2] continues to show evidence for the presence of simultaneity also in this context. The correlation between the structural disturbances is estimated to be approximately -.148. The results show that personal characteristics variables included in both equations have the expected signs and are of a reasonable size.

We note that also in this context, while there is some evidence for simultaneity, there is no strong evidence of non recursiveness. The propensity of the wife to work has a small positive direct effect on the mortgage propensity, but the estimated coefficient is only marginally significantly different from zero. The coefficient of the wife work propensity in the mortgage equation is .095 with a .060 standard error. Conversely, the effect of the mortgage propensity on the participation propensity is positive and quite significant statistically (.170 with a standard error of .05).

The variable indicating whether the household has bought the house after 1992 is positive and significantly different from zero. This suggests that purchasing a house after the 1992 increases the probability of using mortgages. Consistent with aggregate evidence reflecting institutional changes, in 1993 homeowners were much more likely to have a mortgage. The year dummy is in fact very significant in the mortgage equation. However the year dummy is not significant in the wife labor market participation equation, thus the participation rate of wives in this population seems to have increased from 1989 to 1993 not only through any secular trend but partially due to other factors, including the increased percentage of homeowning households which had the pressure of a mortgage.

We have used the coefficients of the simultaneous equation model to compute the elasticities of wives' participation to changes in the mortgage.

We consider the effect on wives' labor market participation behavior in response to shifts in the constant terms in the mortgage equation. We interpret these shifts as resulting from changes in the institutional setting in which agents operate.

We are interested in a) the elasticity defined as the percentage change in the probability of agent i participating in the labor market (or analogously having a mortgage) associated with a perturbation of the constant term, divided by the percentage change in the constant term of the mortgage equation, b) the "derived" elasticity defined as the ratio of the percentage change in the probability of labor market participation induced by the shift in the constant term of the mortgage equation divided by the percentage change in the mortgage induced by this same shift.

We have computed several elasticities (evaluated at the sample means). We found that the elasticity of mortgage usage with respect to a change in the constant term in the mortgage equation was .71. The "cross" elasticity of participation with respect to a change in the constant term in the mortgage equation is .26. This indicates that while there is some responsiveness in labor market participation to changes in the structure of the mortgage market, it is not quantitatively large. However, it does give predictions consistent with the empirical evidence over the sample period. For example, the "derived" elasticity defined as the ratio of the percentage change in participation divided by the percentage change in mortgage usage when both are induced by a shift in the constant term in the mortgage equation is .31. Over the period from 1989 to 1993, mortgage usage among homeowners increased from 16 to 28 percent, while participation of wives in the homeowners sample increased from 43 to 48 percent. Our experiment predicts that for this rate of growth in mortgage usage an increase in participation of 43 to 46.7, which is close to the observed growth rate. This would seem to lend some credibility to our model estimates and our conceptualization of the policy experiment.

6. Conclusions

In this paper, we analyze the relationship between housing financing decisions and family allocation of time using Italian data. We investigate whether mortgage commitments as well as other debts affect wives' labor supply decisions. We address the issue of endogeneity in a simultaneous equations

framework.

We estimate models in which wives's labor participation decisions depend not only on personal characteristics and income variables, but also on the household debt commitment. We have compared these models with models in which participation and mortgage decisions are jointly determined. The empirical results of both models for the cross section analysis (1993) show that the mortgage debt is a strong determinant of wives' labor force participation, while other household's debts are not.

We then analyze the effect that the change in financial market regulations has on mortgage usage and wives' participation rates using a pooled data set 1989-1993. Our results imply that changes in the mortgage requirements were important reasons for the increase in the labor market participation of wives among homeowners over the 1989-93 period. Our analysis shows that there are important spillover effects from the financial markets to the labor markets and that the financial liberalization now in progress can be expected to have a significant impact on female labor participation among homeowners.

TABLE 2

Participation Rates of Husbands and Wives across Financing Modes

	All	Buyers	Mortgage	Gift and Bequest
Husband age	43.7	44.0	42.2	42.6
Wife age	40.1	40.3	39.0	39.1
Husband participation	97.6	98.2	99.0	95.1
Wife participation	48.9	50.4	58.9	42.7
Husband hours of work	40.6	40.8	41.6	39.5
Wife's hours of work	16.2	16.8	19.8	13.5
North	38.4	39.9	39.9	31.9
Husband Schooling	9.9	9.8	10.6	10.0
Wife schooling	9.5	9.5	10.3	9.5
Number of children	1.7	1.6	1.6	1.7
Number of children 0-6	.34	.31	.35	.46
Husband's Income	27.0	27.8	30.0	23.9
Wife's Income	9.6	10.0	12.0	7.8
Family Debts	4.9	5.7	6.6	3.4
Other Debts	12.7	13.3	17.5	10.2
	(1828)	(1477)	(513)	(351)

TABLE 4

PROBIT ANALYSIS.
Probability of wife working

Variables	*Homeowners*		*Homeowners who bought*	
	I	*II*	*III*	*IV*
Constant	-1.874	-1.828	-1.963	-1.922
	(.259)	(.256)	(.288)	(.287)
Wife's age/10	-.0004	-.006	.022	.017
	(.053)	(.053)	(.060)	(.060)
Children 0-6	-.348	-.365	-.301	-.320
	(.065)	(.066)	(.076)	(.077)
North	.460	.453	.479	.478
	(.069)	(.069)	(.076)	(.076)
Wife Schooling	.153	.153	.158	.158
	(.011)	(.011)	(.012)	(.013)
Husband Schooling	.039	.038	.031	.031
	(.011)	(.011)	(.013)	(.013)
Income/100	-.759	-.730	-.757	-.733
	(.148)	(.150)	(.173)	(.176)
Mortgage	.159	.003	.173	.003
	(.073)	(.001)	(.078)	(.001)
Mother work	.318	.323	.299	.305
	(.072)	(.072)	(.080)	(.080)
Mother in law work	.474	.472	.457	.453
	(.074)	(.074)	(.082)	(.083)
Gift/Bequest	-.135	-.141		
	(.085)	(.084)		
Family debts	-.009	.009	.048	.012
	(.151)	(.006)	(.162)	(.007)
Other debts	.049	.0008	.064	.014
	(.097)	(.006)	(.106)	(.011)
Sample	1828		1477	

TABLE 5

Simultaneous Equation model with latent variables.

(Model 2)

Sample 1993

	Estimates	S.E
Wife's participation Equation		
Constant	-1.531	0.216
Wife's age	0.031	0.078
Wife's schooling	0.145	0.010
N. Children 0-6	-0.233	0.068
North	0.432	0.070
Income/100	-0.452	0.137
Mother work	0.290	0.062
Mother-in-law work	0.428	0.075
Family Debts	-0.101	0.077
Other debts	0.123	0.068
Mortgage propensity	0.420	0.077
Mortgage Equation		
Constant	-0.211	0.229
Wife's Age	0.025	0.054
North	0.140	0.080
Income/100	-0.440	0.136
Husband's Schooling	0.242	0.110
Housing Tenure	0.045	0.006
Bank	0.020	0.009
More banks	0.342	0.076
Wife work propensity	0.091	0.060
ρ	-0.251	
Sample	1477	

TABLE 7

PROBIT MODEL

Probability of wife working

(Model 1)

Pooled sample 1989-1993

Variable	Estimate	S.E	Estimate	S.E
Constant	-1.506	.186	-1.481	.185
Wife's age/10	.003	.038	.001	.038
Children 0-6	-.183	.049	-.190	.050
North	.469	.015	.467	.049
Wife's Schooling	.148	.008	.148	.008
Husband's Schooling	.002	.008	.002	.008
Income/100	-.440	.098	-.431	.098
Mortgage	.195	.057	.004	.001
Family Debts	-.157	.120	-.0005	.005
Other Debts	.115	.076	.010	.007
Year 1993	.059	.049	.067	.049
Sample	3227		3227	

TABLE 8

Simultaneous Equation model with latent variables.

(Model 2)

Pooled sample 1989-1993

	Estimates	S.E
Wife's participation equation		
Constant	-1.325	0.192
Wife's age/10	0.189	0.049
N. Children 0-6	0.024	0.037
North	0.459	0.050
Wife's Schooling	0.147	0.075
Income/100	-0.373	0.080
Family Debt	-0.147	0.122
Other Debt	0.127	0.075
Year 1993	0.018	0.057
Mortgage propensity	0.170	0.049
Mortgage equation		
Constant	-1.100	0.204
Wife's Age/10	0.060	0.039
North	-0.125	0.061
Income/100	-0.448	0.136
Husband's Schooling	0.203	0.093
Housing Tenure	- 0.056	0.005
Bank	0.134	0.056
More banks	0.281	0.062
Bought after 1992	0.261	0.090
Year 1993	0.651	0.052
Wife Work propensity	0.095	0.060
ρ	-0.148	0.089
Sample	3227	

APPENDIX 1

Sample Selection criteria

In this Appendix we report a list of the selection rules in our sample

TABLE A.1

SAMPLE SELECTION

Selection criteria	N. of observations deleted	N. of observations remaining
Selection criteria		
1.Only married couples	2158	5931
2.Only families in which neither the wife nor the husband own a business	401	5432
3.Only families with wives in the age bracket 20-55 and husbands 20-59.	2022	3410
4.Only families in which neither the husbands or wives have zero incomes or are retired and report non-zero income if they work	348	3062
5.Only families which either rent or own	325	2737
6.Only families with no missing values in mortgages, year of house purchasing	21	2716
7.Only families whose residual income (total - wife's labor earnings) is non-negative or zero.	5	2711

APPENDIX 2

The log-likelihood function for Model 2 is:

$$\mathcal{L}(\vartheta_2) = \sum_{i \in S_{00}} \ell n \int_{-\infty}^{-\tilde{m}_{1i}} \int_{-\infty}^{-\tilde{m}_{2i}} f(u,v;\tilde{\rho})\, du\, dv$$

$$+ \sum_{i \in S_{01}} \ell n \int_{-\infty}^{-\tilde{m}_{1i}} \int_{-\tilde{m}_{2i}}^{\infty} f(u,v;\tilde{\rho})\, du\, dv$$

$$+ \sum_{i \in S_{10}} \ell n \int_{-\tilde{m}_{1i}}^{\infty} \int_{-\infty}^{-\tilde{m}_{2i}} f(u,v;\tilde{\rho})\, du\, dv$$

$$+ \sum_{i \in S_{11}} \ell n \int_{-\tilde{m}_{1i}}^{\infty} \int_{-\tilde{m}_{2i}}^{\infty} f(u,v;\tilde{\rho})\, du\, dv ,$$

where: $$\tilde{m}_{1i} = \frac{X_{1i}\beta_1 + \delta_1 X_{2i}\beta_2}{\tau_1} ,$$

$$\tilde{m}_{2i} = \frac{\delta_2 X_{1i}\beta_1 + X_{2i}\beta_2}{\tau_2} ,$$

$$\tau_1 = (1 + \delta_1^2 + 2\delta_1\rho)^{1/2},$$

$$\tau_2 = (1 + \delta_2^2 + 2\delta_2\rho)^{1/2},$$

$$\tilde{\rho} = \frac{\delta_1 + \delta_2 + \rho(1+\delta_1\delta_2)}{\tau_1\tau_2} ,$$

$$\vartheta_2 = (\beta_1' \ \beta_2' \ \delta_1 \ \delta_2 \ \rho)' .$$

All ℓn likelihoods were maximized using the MAXLIK procedure in GAUSS; numerical procedures were used to compute the gradient vector and the Hessian. No unusual problems were encountered in the process of estimating these functions, in part probably due to the relatively large sample size. In

addition, to avoid possible problems we parameterized the correlation coefficient as $\rho = \tanh(\alpha)$, where $\alpha \in \mathbb{R}$ and tanh denotes the hyperbolic tangent function. We then estimated α directly instead of ρ. The maximum likelihood estimate of ρ is then $\tanh(\hat{\alpha})$, where $\hat{\alpha}$ denotes the m.l.e. of α. The standard error of $\hat{\rho}$ was obtained using the delta method.

APPENDIX 3

This appendix contains a description of the method used to compute the elasticities reported in Section 6 from the structural latent variable model of mortgages and participation. We consider the effect on behavior of shifts in the constant terms in the two equations, β_1^1 [in the participation equation] and β_2^1 [in the mortgage equation]. As discussed in the text, we interpret these shifts as resulting from changes in the institutional setting in which agents operate.

The elasticities were computed for the nonrecursive latent variable model without "structural shift," or Model 2. The reduced form of this model is

A.1)
$$y_{1i}^* = (1-\delta_1\delta_2)^{-1}(X_{1i}\beta_1 + \delta_1 X_{2i}\beta_2) + v_{1i}$$
$$y_{2i}^* = (1-\delta_1\delta_2)^{-1}(X_{2i}\beta_2 + \delta_2 X_{1i}\beta_1) + v_{2i},$$

where

$$v_{1i} \equiv (1-\delta_1\delta_2)^{-1}(\varepsilon_{1i} + \delta_1\varepsilon_{2i})$$
$$v_{2i} \equiv (1-\delta_1\delta_2)^{-1}(\delta_2\varepsilon_{1i} + \varepsilon_{2i}) .$$

Define

$$a_{1i} \equiv (1-\delta_1\delta_2)^{-1}(X_{1i}\beta_1 + \delta_1 X_{2i}\beta_2)$$
$$a_{2i} \equiv (1-\delta_1\delta_2)^{-1}(X_{2i}\beta_2 + \delta_2 X_{1i}\beta_1).$$

Then the probability of agent i participating in the labor market is:

$$P(d_{1i} = 1 | X_{1i}, X_{2i}) = \Phi(a_{1i}/\sigma_{v_1}),$$

and the probability of agent i having a mortgage is:

$$P(d_{2i} = 1 | X_{1i}, X_{2i}) = \Phi(a_{2i}/\sigma_{v_2}),$$

where σ_{v_j} is the standard deviation of the reduced-form disturbance in equation j.

Say that an institutional change lowered the barrier to having a mortgage - we model such an event as decreasing the constant term in the second structural latent variable equation. If β_2^1 is perturbed by some amount λ, then we can define the two elasticities:

A.2) $$\zeta_{2,2}(\lambda) = [\Phi(\{a_{2i}+(1-\delta_1\delta_2)^{-1}\lambda\}/\sigma_{v_2}) / \Phi(a_{2i}/\sigma_{v_2}) - 1] / [\lambda/\beta_2^1]$$

$$\zeta_{1,2}(\lambda)] [\Phi(\{a_{1i}+(1-\delta_1\delta_2)^{-1}\delta_1\lambda\}/\sigma_{v_1}) / \Phi(a_{1i}/\sigma_{v_1}) - 1] / [\lambda/\beta_2^1].$$

The first elasticity in (a.2) is defined as the percentage change in the probability of agent i having a mortgage associated with a perturbation of the constant term to $\beta_2^1 + \lambda$ divided by the percentage change in the constant term. The "cross-elasticity" $\zeta_{1,2}(\lambda)$ is defined as the ratio of the percentage change in the probability of labor market participation induced by the shift in β_2^1 divided by the percentage change in β_2^1.

Analogous elasticities are defined when the constant term in first structural equation is perturbed by some amount λ. These are given by:

A.3) $$\zeta_{1,1}(\lambda) = [\Phi(\{a_{1i}+(1-\delta_1\delta_2)^{-1}\lambda\}/\sigma_{v_1}) / \Phi(a_{1i}/\sigma_{v_1}) - 1] / [\lambda/\beta_1^1]$$

$$\zeta_{2,1}(\lambda) = [\Phi(\{a_{2i}+(1-\delta_1\delta_2)^{-1}\delta_2\lambda\}/\sigma_{v_2}) / \Phi(a_{21}/\sigma_{v_2}) - 1] / [\lambda/\beta_1^1],$$

where $\zeta_{1,1}(\lambda)$ is the percentage change of the participation probability induced by a perturbation of λ in the coefficient β_1^1 in the structural participation equation. $\zeta_{2,1}(\lambda)$ is the elasticity of the mortgage rate defined with respect to the same perturbation.

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