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## What Drives Household Borrowing and Credit Constraints?

Evidence from Bosnia and Herzegovina

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**IMF Working Paper**

European Department

**What Drives Household Borrowing and Credit Constraints?  
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Authorized for distribution by Mark Griffiths

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**Abstract**

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Although Bosnia and Herzegovina (BiH) has experienced rapid growth in credit to households in recent years, most individuals are still credit constrained. This paper analyzes the determinants of household credit demand and credit constraints in BiH. To our knowledge, it is the first study on this topic employing household survey data (2001 and 2004) from Emerging Europe. Our results highlight the impact of the post-conflict and transitional nature of the country on the behavior of borrowers and lenders. As expected, age, income, wealth and education qualifications are the main factors driving credit market participation, while high income and high wealth lower credit constraints. In BiH, the probability of credit market participation peaks at 45 years old, considerably higher than in the advanced countries. At the same time, older individuals are significantly more constrained than their peers in the advanced countries. The results imply that the current credit boom may largely reflect the overall post-war demand, and indicate the worse-off position of the older generation in transition economy. Moreover, the results underscore the structural nature of unemployment as well as the mismatch between education qualifications and earning prospects in BiH. Education variables have no significant effect on the likelihood of being constrained, while, unlike in the advanced countries, being unemployed significantly increases the likelihood.

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## **What Drives Household Borrowing and Credit Constraints? Evidence from Bosnia and Herzegovina**

### **I. INTRODUCTION**

Many Central and Eastern European (CEE) as well as South Eastern European (SEE) countries have experienced rapid credit growth in recent years. Rapid credit growth, especially for household credit, has been supported by favorable macroeconomic conditions. Lower interest rates, low inflation and robust economic growth have made borrowing more attractive and affordable. With many banks—especially foreign-owned ones—entering the market and competing for new customers, the supply of funds for household loans has increased. Credit constraints appear to have eased as households are able to borrow for their consumption and housing needs.

The features of Bosnia & Herzegovina (BiH)'s credit boom reflect the general trends in the region. Although the boom started later than its peers due to its late start to transition and the war in the 1990s, BiH has caught up quickly with the regional trends. Real credit growth averaged 22.8 percent between 2001 and 2006, and the credit-to-GDP ratio more than doubled during the same period. As in other CEE and SEE countries, the rapid credit growth has been led by lending to households. In BiH, the average real growth of credit to households between 2001 and 2006 was about 50 percent, while the real growth rate for credit to enterprises was only 13.5 percent.

This paper examines the determinants of Bosnian households' participation in the debt market and their credit constraints. To date, empirical studies on the determinants of household debt and credit constraints have mainly been limited to a few advanced countries. To our knowledge, there has been no study on this topic in Eastern European or transition countries. This paper utilizes a unique panel data set, "Living in BiH", which provides individual-level and household-level socioeconomic data, as well as self-reported information on household debt and individuals' participation in the debt market during 2001-04. The paper identifies and models the determinants of the likelihood of credit market participation and being credit constrained, and the size of debt desired by Bosnian individuals.

For consumers in any country, the decision to enter the debt market depends on both demand and supply factors. On the demand side, consumers' desire to borrow will determine their probability of participating in the credit market. On the supply side, lenders will decide whether and how much to lend, considering the capacity of their potential borrowers to repay. Actual debt observed is the result of both demand and supply factors. It will be lower than desired if consumers are not able to obtain the credit they want, due either to quantity rationing or the high price of credits. Consumers who are not able to obtain as much credit as they want are credit constrained.

Understanding credit constraints and their determinants has important policy implications at both the micro and macro levels. At the micro level, the determinants of credit constraint help shed light on the credit granting process of the lenders. At the macro level, credit

constraints have been cited to explain the observed correlation between current consumption and income growth, and the rejection of the permanent income hypothesis. In other words, constrained consumers are not able to smooth their consumption effectively, leading to excess sensitivity of consumption to current income fluctuation. The presence of consumers with credit constraints also has implications for the design of fiscal policy. A fiscal stimulus package that targets population groups that are more likely to face binding borrowing constraints is likely to be most effective.

Our results, compared with existing studies from advanced countries, highlight the impact of the post-conflict and transitional nature of the country on the behavior of borrowers and lenders. As expected, age, income, wealth and education qualifications are the main factors driving credit market participation, while high income and high wealth lower credit constraints. In BiH, the probability of credit market participation peaks at 45 years old, considerably higher than in the advanced countries. At the same time, older individuals are significantly more constrained than their peers in the advanced countries. The results imply that the current credit boom largely reflect the overall post-war demand, and indicates the worse-off position of the older generation in transition economy. Moreover, our results also underscore the structural nature of unemployment as well as the mismatch between education qualifications and earning prospects in BiH. Education variables have no significant effect on the likelihood of being constrained, while, unlike in the advanced countries, being unemployed significantly increases the likelihood.

The rest of the paper is organized as follows. Section II provides a theoretical framework and discusses the related literature. Section III describes the methodology. Section IV presents the data. Section V discusses the empirical results, and Section VI concludes.

## II. THEORETICAL FRAMEWORK AND RELATED LITERATURE

The starting point of the theory of household debt and credit constraints is the life-cycle model and the permanent income hypothesis of Modigliani (1986) and Friedman (1957). A representative household maximizes the utility function subject to an intertemporal budget constraint:

$$\begin{aligned} \max \quad & E \left[ \sum_{t=0}^T (1+\theta)^{-t} u(c_t) \right] \\ \text{s.t.} \quad & A_{t+1} = (1+r)(A_t + y_t - c_t), \end{aligned}$$

where  $c$  is consumption,  $y$  is labor income,  $A$  is household net assets,  $r$  is the rate of return on the assets, and  $\theta$  is the discount rate. The first-order condition of this problem is the standard Euler equation:

$$E_t u'(c_{t+1}) = \frac{(1+\theta)}{(1+r)} u'(c_t).$$

The Euler equation implies that households will try to maximize their utility by smoothing marginal utility over the life cycle. In a period of low income, households will borrow to finance current consumption; households will repay in a period of high income. In a world with perfect capital markets, households will be able to borrow the amount of money they desire to smooth their consumption. According to this basic model, current consumption should be independent of current income.

However, empirical studies show that consumption tracks income over the life cycle—an outcome that calls into question the simple versions of the theory (see, for example, Hall and Mishkin (1982) and Zeldes (1989)). One of the main explanations for this is that at least some consumers face binding credit constraints. Although these consumers would like to borrow (or borrow more) to smooth their consumption, they are not able to borrow at all or as much as they would like, or that the rate at which they borrow is prohibitively expensive. Earlier empirical papers do not directly observe credit constraints. Instead, they evaluate the gap between desired and actual consumption of households using cross-sectional data by simply assuming that individuals with certain characteristics are more likely to be credit constrained (see Hayashi (1985) and Jappelli and Pagano (1988), for example).

To better understand the nature of credit constraints, a number of empirical studies focus on the characteristics of consumers who are more likely to be credit constrained. Most rely on self-reported survey data to identify consumers with credit constraints. These studies estimate the probability of being credit constrained and the demand for household credits. Early works such as Jappelli (1990), Cox and Jappelli (1993), Duca and Rosenthal (1993), and Crook (2001) focus on the U.S. and use the Federal Reserve Board's Survey of Consumer Finance data. Other empirical works mostly focus on the OECD countries: Crook and Hochguertel (2005) for the U.S., Italy and the Netherlands; Magri (2002) for Italy; Del-Rio and Young (2005), and Benito and Mumtaz (2006) for the U.K.

Recent studies indicate that household income and age of the household head are important determinants of demand for debt. In recent empirical evidence for the U.S. (using data from 1990-95), Crook (2001) finds that a household demands less debt when the head of household is over 55 years old and when he/she is relatively risk averse. A household demands more debt when its income is higher, when it owns a home, when the family size is larger and when the head is working. Lower probability of credit constraint is observed when a household owns a home, has high net worth and the head is older than 55, and has spent many years at a job. For Italy, Magri (2002) finds that the role of income is important, with the uncertainty of income reducing the demand for loans. In addition, residence is a crucial parameter for credit rationing, which is particularly strong in regions where banks face a longer recovery time in the event of customer default.

Crook and Hochguertel (2005) explore credit demand and credit constraints in the U.S., Italy and the Netherlands. They find that higher age and wealth reduces the chance of being constrained. The self-employed face a greater chance of being discouraged or turned down in all three countries, especially in the U.S. They also find that a much greater proportion of U.S. households apply for credit than for the other two countries. Of those who apply, a much higher proportion are rejected in the U.S. Once households that are discouraged from

applying are included, a considerably smaller percentage of Italian and Dutch households are credit constrained, compared with U.S. households.

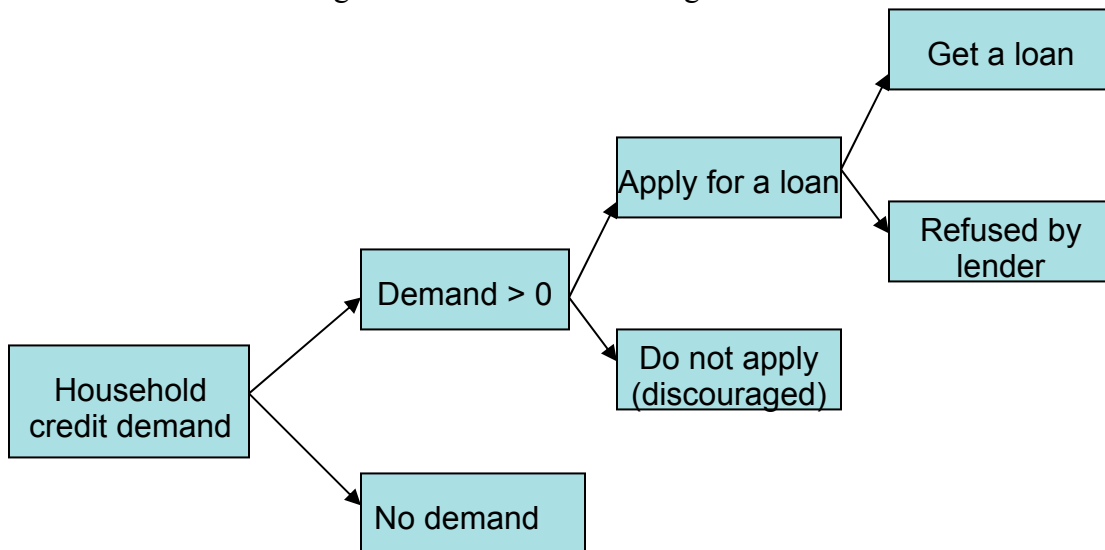
Del-Rio and Young (2005) examine the determinants of participation in the unsecured debt market and the amount borrowed for 1995 and 2000 in the U.K. Age, income, positive financial prospects and housing tenure are found to be significant for the probability of participation. For the level of borrowing, income is the main variable explaining the cross-sectional differences in unsecured debts.

To our knowledge, there are two relevant empirical studies on this topic in emerging market countries. Using household surveys from Thailand, Thaicharoen, Ariyapruchya and Chucherd (2004) analyze credit demand and constraints and find that low income, low age, low educational attainment, and occupations such as farm operator or low-skilled laborer tend to be associated with greater demand for loans. They also find that high income, high age, being female, a farm operator or having an education at the secondary level or above tend to reduce the likelihood of being credit constrained. Arvai and Toth (2001) estimate Hungarian consumers' propensity to borrow using a 2000 household survey. They find that the education level of the head of household, household income, future income expectations and past borrowing experience have positive effect on the propensity to borrow.

### III. METHODOLOGY

The decision to enter the credit market depends on both credit demand and supply. Observed debt levels can thus be considered the result of a multistage decision process, where demand is potentially rationed by supply (Figure 1):

Figure 1. Household Multistage Decision Process



A household may or may not have demand for credit. If a household has demand for credit, it may or may not apply for a loan, as it may be discouraged by the prospect of possible



rejection or its inability to afford debt services in the future. Then, if the household is not discouraged, and applies for a loan, it may be rejected by the lender. Households that are not rejected will end up having positive debt. The decision process thus shows that there are many ways in which the observed debt holding may take a value of zero. Expectations, especially about future income, play a key role in the decision process of the households.

### ***Estimation models***

We set up estimation models that take into account the multistage decision process of household credit demand. We first estimate separately the outcome of two decision processes: (i) the probability of having demand for credit (or credit market participation); and (ii) the probability of credit constraint. Then we estimate (iii) the desired amount of debt.

We introduce the equations for the two decision process which are based on the “latent” demand and supply functions:

$$L_D = \alpha' X_1 + \varepsilon_D \quad (1)$$

$$L_S = \gamma' X_2 + \varepsilon_S. \quad (2)$$

#### **(i) Credit market participation**

An individual’s desired stock of debt depends on a set of explanatory variables,  $X_1$ , and can be represented by the latent demand function  $L_D$  in equation (2).  $L_D$  is an unobservable or latent continuous random variable.  $X_1$  is a vector of variables that determines whether a person would desire to hold positive debt, and  $\varepsilon_D$  is a random error term.

We are only able to observe whether individuals have positive demand for debt through observable information from the survey questionnaire. We define another variable— $d$  so that

$$\begin{aligned} &\text{Individual desires positive debt if } L_D > 0 \text{ } d=1 \\ &\text{Individual does not desire positive debt if } L_D < 0 \text{ } d=0. \end{aligned}$$

Here,  $d$  is observable. We identify  $d=1$  if an individual has made an attempt to borrow or has been discouraged from borrowing.<sup>2</sup> We define  $d=0$  if an individual has not attempted to borrow because she has no need. We exclude individuals who have not attempted to borrow

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<sup>2</sup> In this case, an individual has been discouraged if she indicates that the reason for not attempting to borrow is “too expensive,” “believed would be refused,” or “inadequate collateral.”

because of other reasons.<sup>3</sup> We estimate a probit model with  $d$  as a dependent variable in a pooled and random effect panel specification<sup>4</sup>.

## (ii) Credit constraint

On the supply side, although an individual may want positive debt, she is subject to the lender's evaluation in equation (3).  $L_s$  is an unobservable continuous random variable. And  $X_2$  is a vector of variables that affect the lender's decision to grant a debt or not.

If  $L_D > L_s$ , such individual is credit constraint. We define a corresponding binary variable  $s$  so that:

$$\begin{aligned} \text{Individual is not credit constrained if } L_s > 0 \quad s=1 \\ \text{Individual is credit constrained if } L_s < 0 \quad s=0 \end{aligned}$$

Here,  $s$  is observable through the survey questionnaire. We define  $s = 0$  if an individual has attempted to borrow but has been refused, or has been discouraged. We identify  $s = 1$  if an individual was able to obtain a loan. We estimate a probit model with  $1-s$ , i.e. the probability of being constrained, as a dependent variable in a pooled and random effect panel specification.

## (iii) Desired amount of debt

We suppose an individual's desired stock of debt— $DD$  is associated with a set of variables, which are indicated by a vector  $X$ , such that

$$DD = \beta' X + \varepsilon_{DD} \quad (3)$$

where  $\varepsilon_{DD}$  is the random error term.

We estimate equation (3) by (a) a simple regression; and (b) a two-step Heckman selection model.

Based on our data set,  $DD$  is not directly observable. We can observe only the amount of debt each individual has obtained if the individual has a positive credit demand and is not totally credit constrained. If we estimate equation (3) using the observed amount of debt as

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<sup>3</sup> Other reasons include “do not like to be in debt,” “do not know any lender,” and “other.” It is not clear, for example, whether individuals who have not attempted to borrow because they do not like to be in debt desire positive debt.

<sup>4</sup> We do not use fixed effect estimator because, for binary choice models, fixed effect estimator is inconsistent and biased when  $t$  is small (see Hsiao (1996) for analytic results or Katz (2001), for example, for Monte Carlo studies of binary choice estimators).

the dependent variable, we may run into a selection bias problem, as the observable amount of debt is subject to two selection mechanisms.

To take into account the two selection mechanisms, we estimate desired debt through the Heckman selection model (Heckman, 1979) using inverse Mills ratios (IMRs).<sup>5</sup> The basic model comprises of two steps. We use the estimates from the two selection equations (from part (i) and part (ii)) to include every individual who wants to participate in the credit market. In the second step, we estimate the desired stock of debt given the extra information obtained from the first step.

In the second step of the Heckman model, we include the two IMRs into the desired debt function. First, the conditional expectation of desired debt (equation (3)) can be expressed as follows:

$$E(DD|d = 1, s = 1) = \beta' X + E(\varepsilon|d = 1, s = 1). \quad (4)$$

Suppose  $(\varepsilon_{DD}, \varepsilon_D, \varepsilon_S)$  are all normally distributed with variance  $(\sigma, 1, 1)$ ; then the covariance matrix will be

$$V = \begin{pmatrix} \sigma^2 & \sigma_{DD,D} & \sigma_{DD,S} \\ \sigma_{D,DD} & 1 & \sigma_{D,S} \\ \sigma_{S,DD} & \sigma_{S,D} & 1 \end{pmatrix}.$$

Thus,  $E(\varepsilon|d = 1, s = 1) = E(\varepsilon|\varepsilon_D > -\alpha' X_1, \varepsilon_S > -\gamma' X_2) = \sigma_{DD,D} M_{DD,D} + \sigma_{DD,S} M_{DD,S}$ .

If  $\varepsilon_S$  and  $\varepsilon_D$  are uncorrelated, then  $M_{DD,D}$  and  $M_{DD,S}$  are the IMRs from equations (2) and (3). If they are correlated, we can estimate  $M_{DD,D}$  and  $M_{DD,S}$  through a bivariate probit model. In our model, however, we assume that  $\varepsilon_S$  and  $\varepsilon_D$  are uncorrelated and therefore that  $M_{DD,D}$  and  $M_{DD,S}$  can be directly computed from the selection equations. Therefore, we include the two inverse Mills ratios into the desired debt function (1) as follows:

$$DD = \beta' X + \sigma_{DD,D} M_{DD,D} + \sigma_{DD,S} M_{DD,S} + \varepsilon \quad (5)$$

All estimations are done using both a pooled ordinary least squares (OLS) and a panel estimation. In the panel specification, we use the selection correction methodology as in Wooldridge (1995).

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<sup>5</sup> Heckman selection model can be estimated by a maximum likelihood method or by a two-step estimation using the inverse Mills ratio. The maximum likelihood estimation is more consistent, but it requires a large sample to allow for convergence to a solution. The inverse Mills ratio method is more flexible, and is the one used in this paper. The inverse Mills ratio is  $\lambda(z) = f(z)/(1-F(z))$  where  $f$  is the standard normal probability distribution function and  $F$  is the standard normal cumulative distribution function.

Following Crook (1996) and Duca and Rosenthal (1993), we assume that the same variables determined the probability of having debt and the amount borrowed (allowing for different parameters in the participation and debt equations). This is due to the difficulty in arguing for a strong theoretical case to include supplementary variables that affect participation decision but do not influence the amount of borrowing for identification purpose. We therefore also estimate equation (3) using simple regressions without any selection model (similar to the approach in Del-Rio and Young (2005)). The results from the two estimations do not differ much, especially in the total sample.

One caveat to the estimation is that even if we observe a positive debt holding, we do not know whether the individual may be partially constrained because we have no information about the lender's evaluation of the debt request. Similar to Crook (2001) and Magri (2002), we treat positive debt holding as no credit constraint, bearing in mind that we may underestimate the probability of being credit constrained.

### ***Relevant variables***

In this section we discuss the relevant variables in our estimation models. Table 1 summarizes some of the main independent variables and their expected effects on the three dependent variables.

Table 1. Independent Variables and Their Expected Relationships with Debt Demand and Supply

Variables	Demand	Supply
Age	Inverted-U shape	+
Net wealth	-	+
Current income	+/-	+
Education	+	+

On the demand side of the credit market, *age* is one of the most important factors suggested by theory. Young households and individuals are likely to have a high demand for debt because of their expectation of higher income and higher consumption in the future compared with their current low income. As their age increases, their income becomes higher which make them less likely to borrow because they have enough income to support their demand. We can expect that there is a certain age threshold beyond which the desired debt will stop growing and start falling. In other words, the relationship between the probability of borrowing and age is expected to have an inverted U shape. The lenders, however, are likely to favor older borrowers as their ability to pay is higher. In order to capture this nonlinear relationship, we use both linear and quadratic terms of age as independent variables.

The second important factor is *net wealth*. On the supply side, net wealth is a good measurement of the borrower's repayment ability. The higher the net wealth is, the higher the

probability of obtaining a loan. On the demand side, however, given higher net wealth, an individual can afford more desired consumption and may not need to borrow.

We use proxies for net wealth. Unfortunately Living in BiH does not contain information on net wealth or total assets; asset-related data include only household durables, and there is no information on housing value or financial assets. We therefore use the total value of household durables as the main proxy for net wealth. Home ownership dummies are also used as another proxy for net wealth. There are three types of residencies in BiH: owner, renter and temporary stay (including occupying it for free or illegal stay).

*Income* is another important factor. From the lender's point of view, what matters is the expected income in the future rather than current income. We use education dummy variables to proxy the expected income profile, following our assumption that the probability of obtaining a loan will be higher for individuals with higher education levels. Our education dummy variables represent individuals who have finished at the zero, primary, secondary, vocational, two-year college and four-year university levels. We can also expect that lenders would prefer higher-educated customers because they usually have lower income volatility and, therefore, smaller default risk. The relationship between current income and debt is, however, not certain. Normally, the higher the current income, the smaller the amount of debt demand. However, the amount of debt demanded may be larger as current income increases, especially if the increase is triggered by a permanent income shock. Again, to capture the possible nonlinearity in the relationship, we use both the linear and quadratic terms.

Other socioeconomic variables that are thought to affect debt supply and demand include *family size, gender, labor market status, and status in the household*. Individuals in a large family are more likely to borrow than those in a smaller family as the large family is more likely to have a higher dependency ratio. To capture the effect of gender, a dummy for female is included. On labor market status, we divide individuals into four groups—dependent workers, self-employed, unemployed and inactive.<sup>6</sup> We expect that, compared with people who are employed, the unemployed individuals may be more likely to demand debt because they have no current income, especially if the unemployment is temporary in nature. At the same time, they will be more likely to be rejected by the lenders. We also run the estimations only for employed individuals to see the effect of different types of employment. We divide employed people into the following groups—entrepreneur, self-employed, public sector employee, private sector employee, farmers, those with unpaid jobs and those with other jobs. The *head of household* dummy variable is also included to capture the different status within the household. The lender is more likely to take into account whether the potential borrower is the head of the household as the head has more power than other household members in controlling household assets.

We include dummies for *entities* and *level of urbanization* because the risk level in the residence area may also affect both the demand and supply of credits. In BiH, there are two

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<sup>6</sup> Dependent workers are those who are employed by employer. The “inactive” group includes people who are not available in the labor market. Students, retired workers, housewives and the disabled belong to this group.

main entities—the Federation of BiH (Federation hereafter) and the Republika Srpska (RS hereafter). Municipalities are divided into three groups: the urban area, rural area and mixed area. The poverty rate is higher in general in the rural area and unemployment rate is higher in the mixed area. In these areas of greater economic risks, lenders may be less inclined to supply credits. On the demand side, the effects are unclear.

For more details on the definition of the variables, see the Appendix.

#### IV. DATA

We use a panel data set “Living in BiH” which covers individual-level and household-level socioeconomic information, as well as some household finance variables for the period 2001-2004 (see the Appendix for more details on the data set). Because the data are more complete for 2001 and 2004, we use only the data from these two years.

Overall summary statistics show that the demand for debt in BiH increased over the period, while credit constraint also went up. The statistics also suggest significant financial deepening during the period. There are also some noticeable differences in the characteristics of those who were constrained, those who were unconstrained, those who had debt, and those who had no debt.

Table 2 shows the overall picture of participation and constraint status in 2001 and 2004. Bosnian individuals’ desire to participate in the credit market increased from about 40 percent of the sample to 47 percent over the four-year period. Given the need, about 75 percent of the sample reported that they were constrained in 2001. That figure increased to about 80 percent in 2004.

Table 2. Credit Market Participation and Credit Constraint, 2001 and 2004

Debt situation	2001	2004
Need debt (percent of total)	39.7	47.1
Constrained given need (percent of those who need debt)	75.4	80.5
Unconstrained given need (percent of those who need debt)	24.6	19.5

Of those who were constrained, more than 90 percent were discouraged from borrowing, and only 5-8 percent were refused a loan (Table 4).

Table 3. Type of Credit Constraint, 2001 and 2004 (In Percent)

Credit constrained	2001	2004
Refused a loan	7.6	4.8
Discouraged from borrowing	92.4	95.2

Table 4 detail the main reasons for obtaining loans and not attempting to borrow. In 2001, the main reason for obtaining loans was for consumption needs. The same data are not available for 2004. For those who did not attempt to borrow, the main reason was that there was no

need. The need increased over the four-year period, as shown in Table 2. The share of those who believed that they would be refused and those with inadequate collateral went up over the years, while the share of individuals who did not know any lender fell in 2004 to about half of the 2001 figure.

Table 4. Main Reasons for Obtaining Loans and Not Attempting to Borrow, 2001 and 2004 (In Percent)

Main reason for obtaining loans	2001	Main reason for not attempting to borrow	2001	2004
Buy inputs/working capital	2.5	No need	35.5	27.4
Investment in equipment/lands/building/animals	5.4	Believed would be refused	9.7	13.1
Consumption needs	73.4	Too expensive	14.9	14.8
Consumer durables	1.7	Inadequate collateral	7.0	13.5
Purchase dwelling	1.3	Do not like to be in debt	19.1	19.2
Reconstruction of dwelling	13.1	Do not know any lender	10.7	4.7
Others	2.7	Other	3.0	7.4

Those who applied and were refused were mainly refused by friends and other institutions in 2001 (Table 5).<sup>7</sup> However, in 2004, 40 percent of the refusals came from banks, which mainly reflects the process of financial deepening, as borrowers were moving away from informal sources towards banks.

Table 5. Refusal by Type of Lender, 2001 and 2004 (In percent)

Refused by	2001	2004
Banks	12.9	40.0
Government agency	9.7	0.0
Credit union	2.4	9.2
Employer	14.1	3.8
Relative	8.5	9.8
Friend	20.6	17.6
Other individual	6.1	16.3
Other institution	25.7	3.2

Table 6 presents the sample mean values of the variables used for the analysis. The sample is divided into five groups: those who need debt, are constrained, are unconstrained, have debt, and have no debt. Comparing individuals who have debt, and those do not, average income is significantly higher for those with debt. The employment rate of those with debt is also much higher than those without. The same holds when comparing constrained and unconstrained individuals. Unconstrained ones have significantly higher average income, slightly higher average age, and much higher employment rate. The percentage of female in the constrained group is also significantly higher than in the unconstrained group. The difference in the level of education attainment between the two groups is not obvious.

<sup>7</sup> Other institutions include NGOs, enterprise funds, and other coops.

## V. EMPIRICAL RESULTS

Although a households is usually assumed to be one decision-making unit, the empirical work here employs data at the individual level to maximize the variation and the number of observations. Maximizing the number of observations is especially important in estimating the amount of desired debt because the number of those with debt is quite low. The results largely hold when we use household-level data and the characteristics of the heads of households.<sup>8</sup>

Table 7 shows the results of the probit estimations on the probability of credit market participation and Table 8 presents the marginal effects of the estimations. The results from both pooled and panel estimations are presented in the table. The estimations are run using the total sample and the sample of employed individuals.

Table 9 reports the probit estimation results on the probability of credit constraints and Table 10 presents the marginal effects of the estimations. Results from both pooled and panel specifications are reported. The estimations are run using the total sample and the sample of employed individuals.

Tables 11 reports the results of the estimations of desired debt level. We show the results for OLS estimations and estimations with Heckman selection models, both for pooled and panel specifications. The OLS estimations only include individuals with positive debts; they do not take into account individuals who may have a positive demand but were discouraged from the market, or those who requested a loan but were rejected. The estimations with the Heckman selection model take into account two selection equations that identifies the probability of participating in the credit market and the probability of being credit constrained. The results show that the coefficients of the IMRs of the credit-rationing selection equation are significant only in the employed sample. We therefore focus on the OLS pooled and panel results for the estimations using total sample, and Heckman model for the estimations using employed sample.

### ***Results***

We now discuss the results of each potential explanatory variable and its effect on the participation decision, credit constraint and the amount of desired debt.

#### *Age*

As expected, following the life-cycle model of consumption and previous empirical works, the probability of credit market participation is a concave function of age, and the coefficients for age and age-squared are highly significant in all specifications. Individuals, in their 20-30s prefer to borrow more as their age increases. After hitting a certain age

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<sup>8</sup> Del-Rio and Young (2005) also employ individual-level data.



threshold, this probability declines. Our analysis shows that the threshold age for Bosnia is around 45.

The age profile is also significantly associated with the probability of credit constraint. The probability is high at younger ages and decreases as age increases until it reaches the minimum at around 47 years, which is very close to the threshold age on the demand side. Beyond that age, credit constraints increase with age. Lenders prefer to grant loans to middle-aged individuals rather than to the young and the old because the former generally have more stable income streams and higher net wealth, which leads to lower credit risk.

For the amount of debt desired, *age* is significant only in the estimations with employed sample.

#### *Net wealth*

The results show that the relationship between the probability of credit market participation and log of durables—our proxy for net wealth—follows a hump-shaped pattern. Although we expect that net wealth has a negative relationship with demand, it seems that such relationship holds only once individuals have been endowed with a certain level of net wealth. From a low net wealth level, individuals want to borrow as their net wealth becomes higher. One explanation could be that individuals are more likely to borrow once they acquire some assets to use as collateral. However, as wealth increases beyond a certain point, individuals have less need to borrow as their wealth can generate enough income for consumption.

The relationship between the probability of credit constraint and durables—our proxy for net wealth—also follows a hump-shaped pattern, with the maximum very close to zero. Therefore, for most people, higher wealth means a lower probability of being constrained, as expected. A high value for durables, however, does not significantly affect the amount of desired debt.

Compared with being a renter, being a homeowner—our second proxy for net wealth—is not significantly associated with the probability of credit participation or constraint. This may be because the homeownership rate is already very high across the board. However, homeowners tend to have larger amounts of desired debts. This could be due to the collateral value effect.

#### *Current income*

The relationship between the probability of credit market participation and the log of income follows a hump-shaped pattern. Both first-order and second-order terms are significant. When income is very low, the marginal utility of consumption is very high. This translates into strong demand for debt as most household debt in BiH is for consumption purposes. Once income is higher, individuals can spend it to consume and need to borrow less. Similar to the relationship with durables, the maximum point is at a very low income level, suggesting that the relationship between income and demand is negative for most individuals.

The probability of credit constraint is concave to log income. Again, both first-order and second-order terms are significant, and the maximum point is very close to zero, which implies a negative relationship between income and credit constraint for most people.

Income appears to have the strongest and most significant impact on the amount of desired debt. The relationship between this desired debt amount and current income follows a convex pattern although the minimum point is very small. Beyond that point, as income increases, most individuals would like to borrow more.

### *Educational level*

Although we expect that the relationship between education level and credit market participation will be positive, our results show that the relationship follows a hump-shaped pattern. The coefficients for primary and secondary education variables are positive and significant. For higher education levels, the coefficients are still positive but closed to zero and not significant. The coefficient for four-year university education, however, is negative but insignificant. This could reflect the situation that highly educated individuals already enjoy high income and wealth, and have little need to borrow.

In contrast to the results from the credit market participation estimations, none of the coefficients of education variables are significant in the credit constraint equation. Controlling for other characteristics, individuals with higher education can face as much credit constraint as ones with lower education. There are two possible explanations. First, the lenders may not see that education level is a good proxy for permanent income and, therefore, may not include it in their decision factors. The second possible explanation is that, although educated individuals have higher permanent income, they also request much more debt than individuals with lower education. In other words, as the education level increases, debt demand grows faster than debt supply.

The coefficients of education variables, except for the primary education dummy, are positive and significant in the estimations of the amount of desired debt with total sample. Individuals with higher education demand larger amounts of debt. The effect is strongest for four-year university education. The results imply that, although individuals with higher education are less likely to participate in the credit market, they demand larger amounts of debt once they decide to enter the market. In the sample of employed individuals, however, only the dummies for primary, secondary and vocational education are significant.

### *Other household/personal characteristics*

As expected, family size is positively correlated with credit need. Larger family size implies higher credit need, and the coefficients are significant in all specifications. However, larger family size is not significantly associated with higher credit constraints. In the equation for amount of desired debt, the coefficient of family size variable is also positive but not significant.

With respect to the gender variable, males and females do not significantly differ in their probability of participation, or being credit constrained. However, females are likely to desire larger amount of debt. As for the variable for the status in the household, the head of household tends to have higher probability of participation, be less credit constrained than other family members and demand higher amount of debt. This reflects the head of household's influence over the household assets and consumption decision.

### *Labor market status*

The probability of credit market participation does not differ significantly for unemployed and employed individuals. Inactive individuals such as students, housewives and disables have a lower probability of participation than employed ones. This may be because, even if they have no stable income, many of them receive financial support from other family members and thus do not need to enter the credit market themselves. For employed individuals, however, there is no difference in credit need among different types of employment.

Unemployed and inactive individuals are significantly more credit constrained and desire less debt than employed ones. When considering only employed individuals, those who work for the private sector, are farmers, or work for other jobs or unpaid jobs, are significantly more credit constrained than public sector employees. The coefficients, while positive for entrepreneurs and self-employed, are not significant. These results suggest that job security is an important deciding factor from the lenders' point of view. Individuals working for the private sector may be more constrained because their jobs may be in the informal sector, which is relatively large for the size of the economy.

### *Location*

Compared to individuals in the rural area of the Federation—our base group—individuals in the rural RS have significantly lower probability of participation and a lower probability of being credit constrained. At the same time, individuals in the urban area of the Federation are less likely to participate in the credit market. Those in the mixed area of the RS are also less credit constrained, compared to the base group.

### ***Results in international perspective***

In this section we compare our results for BiH with the empirical results for other countries from Arvai and Toth (2001), Crook (2001), Crook and Hochguertel (2005), Del-Rio and Young (2005), Magri (2002), and Thaicharoen, Ariyapruchya and Chucherd (2004).<sup>9</sup> Although results from different studies may not be directly comparable because the

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<sup>9</sup> Arvai and Toth (2001) study only the probability of participating in the credit market. Other studies include empirical results for credit participation, credit constraints and desired debt amount.

measurements of debt in each paper are not exactly the same, this comparison helps shed light on the institutional or structural differences between these countries.<sup>10</sup>

For credit market participation, we observe the following (Table 12):

- Age significantly affects the probability of participation in all countries in the same way.<sup>11</sup> One important distinction is that the probability of participation reaches the maximum at age 45 in BiH, while the maximum age in other countries is much lower at around 30 years old. In BiH, both the young and the middle aged want to borrow, while in other countries the need for borrowing starts to decline sooner. This may be because of the post-conflict and transitional nature of BiH. After the conflict, the need to borrow may be equally distributed over the age profile because households need to repair their dwellings and replace destroyed durables. Moreover, individuals who would have settled down (and needed to borrow for family expansion and home purchase) in their 30s in the early 1990s had to postpone for another 5-10 years due to the war. As a country that started its transition period later than other countries in the region due to the conflict in the mid- 1990s, Bosnian individuals may have had access to finance for the first time during the observed period and thus been more likely to participate in the credit market regardless of age.
- The effects of current income and education vary across countries. The relationship between credit constraint and income follows a hump-shaped pattern in BiH, Italy and the U.S.; the relationship is positive in the Netherlands, the U.K. and Hungary and negative in Thailand. The relationship between education level and credit market participation follows a hump-shaped pattern in BiH and Thailand. In other words, primary education significantly increases the likelihood of participating in the credit market, but university education reduces the likelihood. In Hungary, the U.S. and the U.K., however, the higher the education qualification, the higher the probability of participation. Education variables have no impact on participation in the Netherlands and Italy.

For the probability of credit constraint, we observe the following (Table 13):

- The first interesting difference is the relationship between age profile and credit constraint. In BiH, the age profile exhibits a U-shaped pattern with the minimum at 47 years old. In other words, the probability of credit constraint declines with age until 47 years is reached. Beyond that, the probability starts increasing with age. In other countries, age has a significant and negative relationship with credit constraint.

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<sup>10</sup> For example, Crook and Hochguertel (2005) exclude debt from relatives or friends for Italy. However, in BiH, debt from relatives or friends still represents a significant amount. Moreover, the share of consumption debt and mortgages in each country is quite different. Crook and Hochguertel (2005) show that more than 40 percent of households in the Netherlands and the U.S. hold mortgages, while only around 10 percent in Italian households have mortgages. Del-Rio and Young (2005) consider only unsecured debts.

<sup>11</sup> For Hungary, Arvai and Toth (2001) do not include the quadratic term for age.

In the U.S., the negative relationship starts at 30 years, and the effect is most pronounced with ages 65 and higher.<sup>12</sup> In the Netherlands and Italy, the negative relationship starts at 50 and 65 years old respectively<sup>13</sup>. In other words, older individuals are punished in the “credit-scoring model” in BiH while being old in other countries gives a higher score. Again, this may be because of the post-conflict and transitional nature of the country. Older individuals in BiH may face higher uncertainty in their income (i.e. through privatization of public companies or unreformed social benefit systems) or may have lost their liquid and fixed assets during the conflict.

- Higher education in general reduces the probability of credit constraint in Italy and Thailand, but has a positive impact (Crook and Hochguertel, 2005) on the probability in the U.S. In BiH, as in the Netherlands, education variables have no significant effect on the likelihood of being constrained.
- Being unemployed significantly increases the probability of credit constraint in BiH, but has no significant effect anywhere else. This may be explained by the fact that most unemployment in BiH is structural. As the unemployed are unlikely to get a job and improve their financial position in the future, the lenders are unlikely to lend to them. At the same time, being self-employed significantly increases the likelihood of being constrained in Italy, the Netherlands and the U.S., but has no significant impact in BiH and Thailand. This may reflect the smaller portion of the labor force in emerging markets being self-employed.

Lastly, with respect to amount of desired debt (Table 14):

- The debt amount significantly increases with higher income in all countries except Italy. Magri(2002) shows a negative and significant relationship between income and loan size; meanwhile in Crook and Hochguertel (2005), income is not a significant determinant, except for the Italians in the highest income group where the effect is positive. In addition, the size of the effect of income becomes smaller with higher income in the U.S., and the effect of income peaks at the middle-income group in the Netherlands; meanwhile the positive coefficient of the quadratic term of income in BiH and Thailand indicates that the effect does not level off at higher income. With demand for debt highest at lower- and middle-income groups, the patterns in the U.S. and the Netherlands seem to be consistent with the life-cycle model. One possible explanation for the high debt at high-income levels in BiH, Thailand and Italy may be

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<sup>12</sup> Crook(2001) shows that the relationship is only significant for age-55-and-higher group. Crook and Hochguertel (2005) show that the relationship is significant starting at age 30, but most pronounced in age-65-and-higher group.

<sup>13</sup> For Italy, Crook and Hochguertel (2005) show that the effect is significant for the age-65-and-higher group. Magri (2002) however finds no significant relationship although she cites work by Jappelli (1990) and Fabbri and Padula (2001) that finds a significantly negative relationship.

that high-income individuals expect their future income to be higher. Therefore, the large amount of desired debt is a result of their rational decisions.

- Another interesting difference is the effect of education. Higher education increases the desired stock of debt in all countries except the U.S., where finishing high school significantly reduces the amount of desired debt, according to Crook and Hochguertel (2005). Also having a college degree has no significant impact, according to Crook and Hochguertel (2005) and Crook (2001).

## VI. CONCLUSIONS

This paper examines the determinants of Bosnian individuals' credit market participation, credit constraint, and amount of desired debt using household survey panel data from 2001 and 2004. It is the first study of credit demand and credit constraint using micro-level data from Emerging Europe. The data show that about 80 percent of the Bosnian individuals who have positive demand for debt were constrained in 2004. Estimation models correcting for selection bias are used to empirically investigate the determinants. Following theory and previous empirical work, the relationship between the probability of credit market participation and age follows an inverted U-shaped pattern. However, the relationship has the maximum point at around age 45, which is much higher than what was found in previous studies on OECD countries. This possibly reflect the pent-up demand of all individuals after the war. Once this hump of credit demand is over, the maximum age may drop and credit growth may stabilize at a lower rate than the current real rate of about 26 percent.

The empirical results on the determinants of credit constraint help shed light on lending criteria or the factors underlying the credit-scoring model in BiH and highlight the impact of the post-conflict and transitional nature of the country on the behavior of lenders. As expected, high income and high wealth imply lower constraints, with the impact of income stronger than that of wealth. In contrast to previous empirical results in other countries, in which the older are less constrained (because lenders perceive them to have a smaller default risk), the relationship between the probability of being constrained and age in BiH follows a U-shaped pattern, with the minimum age around 47. This implies that older individuals in BiH may face higher uncertainty in their income or may have accumulated fewer liquid assets than their peers in the advanced countries, and are therefore more prone to default risks. Again, this possibly reflects the post-conflict and transitional nature of the country.

Moreover, the results on the determinants of credit constraint underscore the structural nature of unemployment as well as the mismatch between education qualifications and earning prospects in BiH. Education variables have no significant effect on the likelihood of being constrained, while, unlike in the advanced countries, being unemployed significantly increases the likelihood.

Income is the main variable explaining the amount of desired debt, similar to previous empirical results from other countries. In contrast to results from the U.S. and the Netherlands, the amount of desired debt in BiH is high at the high-income level. The relationship patterns with the demand for debt at the peak in the lower- and middle-income group in the U.S. and the Netherlands seem to be consistent with the life-cycle model. One

possible explanation for the high debt at high-income levels in BiH (and similarly Thailand and Italy) may be that high-income individuals in these countries have higher future income expectations. Therefore, the large amount of desired debt may be a result of these individuals' rational decisions.

Table 6. Sample Means (Weighted)

Variable	Total Sample			Need debt			Constrained			Not constrained			Has debt			No debt		
	2001	2004	2001	2001	2004	2001	2001	2004	2001	2001	2004	2001	2001	2004	2001	2001	2004	2001
Number of observations	3,604	5,318	1,408	2,607	1,072	2,078	338	529	262	449	3,342	4,869	3,342	4,869	3,342	4,869	3,342	4,869
Individual income (in KM)	5,360	7,494	4,603	6,909	4,375	6,749	5,283	7,561	5,207	7,990	5,373	7,447	5,207	7,990	5,373	7,447	5,207	7,447
Value of household durables (in KM)	2,464	3,158	2,053	2,603	2,029	2,501	2,125	3,016	2,107	3,284	2,494	3,146	2,107	3,284	2,494	3,146	2,107	3,146
Individual debt (in KM)	148	258							1,932	2,998	0	0	1,932	2,998	0	0	1,932	2,998
Log income	3.97	4.88	4.49	4.89	3.84	4.38	6.47	6.96	6.43	7.08	3.76	4.68	6.43	7.08	3.76	4.68	6.43	4.68
Log durables	7.01	7.32	6.75	7.12	6.74	7.05	6.78	7.38	6.78	7.48	7.03	7.31	6.78	7.48	7.03	7.31	6.78	7.31
Age (year)	43.42	43.19	45.78	42.71	44.88	42.11	48.19	45.15	47.85	44.34	43.05	43.08	47.85	44.34	43.05	43.08	47.85	43.08
Family size (in number of persons)	3.57	3.94	3.47	4.05	3.47	4.09	3.50	3.90	3.62	3.96	3.57	3.94	3.62	3.96	3.57	3.94	3.62	3.94
Education variables (in percent)																		
No education	21.10	16.70	19.60	15.20	19.90	16.30	18.60	10.80	17.90	10.80	21.30	17.30	17.90	10.80	21.30	17.30	17.90	17.30
Primary education	29.10	27.20	32.70	28.10	34.40	29.00	27.60	24.80	26.10	24.10	29.40	27.50	26.10	24.10	29.40	27.50	26.10	27.50
Secondary education	28.40	30.10	29.50	33.20	29.10	32.40	30.50	36.80	31.90	35.60	28.10	29.60	31.90	35.60	28.10	29.60	31.90	29.60
Vocational education	15.90	20.50	12.60	18.80	12.00	18.70	15.60	19.10	15.20	20.20	16.00	20.50	15.20	20.20	16.00	20.50	15.20	20.50
College (2-year) education	2.80	2.90	3.00	2.80	3.10	2.40	2.80	4.20	3.20	4.20	2.80	2.80	3.20	4.20	2.80	2.80	3.20	2.80
University (4-year) education	2.60	2.60	2.50	1.90	1.70	1.30	4.90	4.30	5.60	5.10	2.30	2.30	5.60	5.10	2.30	2.30	5.60	2.30
Labor market status (in percent)																		
Employed by employers	27.30	34.60	30.40	39.30	22.00	34.10	56.30	60.40	58.10	64.20	24.70	31.80	58.10	64.20	24.70	31.80	58.10	31.80
Self Employed	3.80	7.10	4.40	7.10	4.20	6.40	4.80	10.00	4.50	10.50	3.70	6.80	4.50	10.50	3.70	6.80	4.50	6.80
Unemployed	22.40	20.30	23.70	21.40	27.00	24.00	13.50	10.80	12.40	9.10	23.20	21.30	12.40	9.10	23.20	21.30	12.40	21.30
Inactive	46.60	38.00	41.60	32.10	46.80	35.40	25.40	18.80	25.00	16.20	48.40	40.10	25.00	16.20	48.40	40.10	25.00	40.10
Gender (in percent)																		
Female	45.90	51.30	38.70	45.60	43.70	49.30	24.70	30.60	25.10	30.80	47.70	53.30	25.10	30.80	47.70	53.30	25.10	53.30
Male	54.10	48.70	61.30	54.40	56.30	50.70	75.30	69.40	74.90	69.20	52.30	46.70	74.90	69.20	52.30	46.70	74.90	46.70
Entity (in percent)																		
Federation	55.80	58.70	60.80	51.70	66.60	50.40	43.80	57.00	46.80	59.00	56.50	58.70	46.80	59.00	56.50	58.70	46.80	58.70
Republika Srpska (RS)	44.20	41.30	39.20	48.30	33.40	49.60	56.20	43.00	53.20	41.00	43.50	41.30	53.20	41.00	43.50	41.30	53.20	41.30
Type of residence (in percent)																		
Homeowner	80.60	86.70	79.40	83.80	80.00	84.20	77.70	82.10	79.70	83.90	80.70	87.00	79.70	83.90	80.70	87.00	79.70	87.00
Renter	16.30	7.20	16.20	8.50	16.40	8.60	15.90	8.30	15.30	7.60	16.40	7.20	15.30	7.60	16.40	7.20	15.30	7.20
Other type of residence	3.10	6.00	4.40	7.70	3.70	7.20	6.40	9.60	4.90	8.50	2.90	5.80	4.90	8.50	2.90	5.80	4.90	5.80
Urbanization level (in percent)																		
Urban area	14.40	13.20	13.40	12.10	15.10	12.30	8.00	11.30	7.50	11.10	15.00	13.40	7.50	11.10	15.00	13.40	7.50	13.40
Mixed area	38.70	35.60	42.30	40.90	41.50	40.70	44.40	41.70	41.60	41.00	38.40	35.10	41.60	41.00	38.40	35.10	41.60	35.10
Rural area	47.00	51.20	44.30	47.00	43.40	46.90	47.60	47.10	50.90	47.90	46.60	51.50	50.90	47.90	46.60	51.50	50.90	51.50
Status in household (in percent)																		
Head of household	37.00	40.20	50.20	44.50	41.30	37.60	76.10	72.50	77.70	72.20	33.60	37.20	77.70	72.20	33.60	37.20	77.70	37.20
Other member of household	63.00	59.80	49.80	55.50	58.70	62.40	23.90	27.50	22.30	27.80	66.40	62.80	22.30	27.80	66.40	62.80	22.30	62.80



Table 7. Results of Probit Estimations of Credit Market Participation

	Pooled, total sample	Panel (RE), total sample	Pooled, employed sample	Panel (RE), employed sample	Base unit
Log income	0.083***	0.087***	0.086**	0.086*	
Log income squared	-0.010***	-0.011***	-0.010**	-0.010*	
Log durables	0.238***	0.246***	0.226***	0.237***	
Log durables squared	-0.028***	-0.029***	-0.024***	-0.025***	
Age	0.047***	0.050***	0.042***	0.045***	
Age squared	-0.001***	-0.001***	-0.001***	-0.001***	
Primary education	0.123***	0.131***	0.134	0.147	No education
Secondary education	0.134***	0.143***	0.172*	0.191*	No education
Vocational education	0.058	0.067	0.031	0.043	No education
College (2 year) education	0.078	0.084	0.181	0.197	No education
University (4 year) education	-0.087	-0.093	-0.141	-0.150	No education
Family size	0.059***	0.061***	0.064***	0.067***	
Entrepreneur			-0.065	-0.057	Public sector employee
Self-employed			-0.077	-0.083	Public sector employee
Private sector employee			-0.004	0.002	Public sector employee
Other jobs			0.174	0.197	Public sector employee
Farmers			-0.098	-0.086	Public sector employee
Unpaid job			-0.037	-0.026	Public sector employee
Self-employed	-0.078	-0.077			Employed by employers
Unemployed	0.061	0.063			Employed by employers
Inactive	-0.182***	-0.191***			Employed by employers
Female	-0.017	-0.016	-0.053	-0.055	Male
Homeowner	0.058	0.067	0.033	0.040	Renter
Other type of residence	0.131*	0.145*	0.079	0.085	Renter
Head of household	0.328***	0.345***	0.297***	0.317***	Household member
Federation & urban	-0.244***	-0.257***	-0.353***	-0.373***	Federation & rural
Federation & mixed	-0.056	-0.058	-0.097	-0.101	Federation & rural
RS & urban	0.050	0.054	0.000	0.003	Federation & rural
RS & mixed	0.033	0.037	-0.123*	-0.123	Federation & rural
RS & rural	-0.170***	-0.174***	-0.179***	-0.184**	Federation & rural
Constant	-1.596***	-1.691***	-1.470***	-1.583***	
Sample Size	8,922.000	8,922.000	3608	3608	
Log-Likelihood	-5795.182	-5789.7496	-2385.1057	-2383.0004	
Wald chi2	639.98	558.91	214.98	182.64	
Pseudo- R^2	0.0562		0.0456		

\*, \*\* and \*\*\* indicate significant level at 10, 5 and 1 percent respectively.

Table 8. Marginal Effects of Probit Estimations of Credit Market Participation

	Pooled, total sample	Panel (RE), total sample	Pooled, employed sample	Panel (RE), employed sample	Base unit
Log income	0.033***	0.035***	0.034**	0.034*	
Log income squared	-0.004***	-0.004***	-0.004**	-0.004*	
Log durables	0.094***	0.097***	0.090***	0.094***	
Log durables squared	-0.011***	-0.011***	-0.010***	-0.010***	
Age	0.019***	0.020***	0.017***	0.018***	
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	
Primary education	0.049***	0.052***	0.053	0.058	No education
Secondary education	0.053***	0.057***	0.069*	0.076*	No education
Vocational education	0.023	0.027	0.012	0.017	No education
College (2 year) education	0.031	0.033	0.072	0.079	No education
University (4 year) education	-0.034	-0.037	-0.056	-0.060	No education
Family size	0.023***	0.024***	0.025***	0.027***	
Entrepreneur			-0.026	-0.023	Public sector employee
Self-employed			-0.031	-0.033	Public sector employee
Employed in the private sector			-0.002	0.001	Public sector employee
Other jobs			0.069	0.078	Public sector employee
Farmers			-0.039	-0.034	Public sector employee
Unpaid job			-0.015	-0.010	Public sector employee
Self-employed	-0.031	-0.031			Employed by employers
Unemployed	0.024	0.025			Employed by employers
Inactive	-0.072***	-0.076***			Employed by employers
Female	-0.007	-0.006	-0.021	-0.022	Male
Homeowner	0.023	0.026	0.013	0.016	Renter
Other type of residence	0.052*	0.057*	0.032	0.034	Renter
Head of household	0.130***	0.136***	0.118***	0.126***	Household member
Federation & urban	-0.097***	-0.102***	-0.141***	-0.149***	Federation & rural
Federation & mixed	-0.022	-0.023	-0.039	-0.040	Federation & rural
RS & urban	0.020	0.021	0.000	0.001	Federation & rural
RS & mixed	0.013	0.015	-0.049*	-0.049	Federation & rural
RS & rural	-0.067***	-0.069***	-0.071***	-0.073**	Federation & rural

\*, \*\* and \*\*\* indicate significant level at 10, 5 and 1 percent respectively.

Table 9. Results of Probit Estimations of Credit Constraint

	Pooled, total sample	Panel (RE), total sample	Pooled, employed sample	Panel (RE), employed sample	Base unit
Log income	0.173***	0.205***	0.132*	0.151*	
Log income squared	-0.028***	-0.033***	-0.019**	-0.023**	
Log durables	0.182***	0.227***	0.282***	0.356***	
Log durables squared	-0.017***	-0.021***	-0.028***	-0.036***	
Age	-0.072***	-0.090***	-0.058***	-0.075***	
Age squared	0.001***	0.001***	0.001***	0.001***	
Primary education	0.008	0.003	-0.084	-0.140	No education
Secondary education	0.081	0.100	0.007	-0.013	No education
Vocational education	-0.012	-0.020	-0.157	-0.220	No education
College (2 year) education	-0.000	-0.030	0.027	0.008	No education
University (4 year) education	-0.032	-0.061	-0.129	-0.223	No education
Family size	0.025	0.031	0.039	0.053*	
Entrepreneur			0.215	0.277	Public sector employee
Self-employed			0.085	0.048	Public sector employee
Employed in the private sector			0.252***	0.310***	Public sector employee
Other jobs			0.432*	0.541*	Public sector employee
Farmers			0.278**	0.361**	Public sector employee
Unpaid job			0.743***	0.921***	Public sector employee
Self-employed	0.028	0.052			Employed by employers
Unemployed	0.293***	0.359***			Employed by employers
Inactive	0.325***	0.393***			Employed by employers
Female	-0.003	-0.000	-0.075	-0.087	Male
Homeowner	0.053	0.056	-0.085	-0.112	Renter
Other type of residence	-0.299***	-0.370***	-0.458***	-0.563***	Renter
Head of household	-0.534***	-0.653***	-0.556***	-0.714***	Household member
Federation & urban	-0.085	-0.111	-0.047	-0.062	Federation & rural
Federation & mixed	0.013	0.010	0.068	0.088	Federation & rural
RS & urban	-0.035	-0.056	0.127	0.158	Federation & rural
RS & mixed	-0.200**	-0.252**	-0.088	-0.128	Federation & rural
RS & rural	-0.382***	-0.467***	-0.251**	-0.309**	Federation & rural
Constant	2.294***	2.845***	1.633***	2.157***	
Sample Size	4,017	4,017	1,747	1,747	
Log-Likelihood	-1,764	-1,753	-996	-989	
Wald chi2	591.04	240.72	229.11	92.78	
Pseudo-R <sup>2</sup>	0.1581		0.1054		

\*, \*\* and \*\*\* indicate significant level at 10, 5 and 1 percent respectively.

Table 10. Marginal Effects of Probit Estimations of Credit Constraint

	Pooled, total sample	Panel (RE), total sample	Pooled, employed sample	Panel (RE), employed sample	Base unit
Log income	0.044***	0.042***	0.047*	0.049*	
Log income squared	-0.007***	-0.007***	-0.007**	-0.007**	
Log durables	0.047***	0.046***	0.099***	0.116***	
Log durables squared	-0.004***	-0.004***	-0.010***	-0.012***	
Age	-0.018***	-0.018***	-0.021***	-0.025***	
Age squared	0.000***	0.000***	0.000***	0.000***	
Primary education	0.002	0.001	-0.030	-0.045	No education
Secondary education	0.021	0.020	0.002	-0.004	No education
Vocational education	-0.003	-0.004	-0.055	-0.072	No education
College (2 year) education	-0.000	-0.006	0.009	0.003	No education
University (4 year) education	-0.008	-0.012	-0.045	-0.072	No education
Family size	0.006	0.006	0.014	0.017*	
Entrepreneur			0.076	0.090	Public sector employee
Self-employed			0.030	0.016	Public sector employee
Employed in the private sector			0.089***	0.101***	Public sector employee
Other jobs			0.152*	0.176*	Public sector employee
Farmers			0.098**	0.117**	Public sector employee
Unpaid job			0.262***	0.300***	Public sector employee
Self-employed	0.007	0.025			Employed by employers
Unemployed	0.075***	0.021***			Employed by employers
Inactive	0.083***	0.019***			Employed by employers
Female	-0.001	0.006	-0.026	-0.028	Male
Homeowner	0.014	0.019	-0.030	-0.036	Renter
Other type of residence	-0.077***	0.029***	-0.162***	-0.183***	Renter
Head of household	-0.137***	0.016***	-0.196***	-0.232***	Household member
Federation & urban	-0.022	0.022	-0.017	-0.020	Federation & rural
Federation & mixed	0.003	0.022	0.024	0.029	Federation & rural
RS & urban	-0.009	0.024	0.045	0.051	Federation & rural
RS & mixed	-0.051**	0.021**	-0.031	-0.042	Federation & rural
RS & rural	-0.098***	0.021***	-0.089**	-0.100**	Federation & rural

\*, \*\* and \*\*\* indicate significant level at 10, 5 and 1 percent respectively.

Table 11. Estimations of Desired Stock of Debt

	Pooled OLS, total sample	Panel (RE), total sample	Two-stage Heckman pooled, total sample	Two-stage Heckman panel, total sample	Pooled OLS, employed sample	Panel (RE), employed sample	Two-stage Heckman pooled, employed sample	Two-stage Heckman panel, employed sample
Log income	-0.474***	-0.471***	-0.475**	-0.475**	-0.630***	-0.624***	-0.893***	-0.755***
Log income squared	0.055***	0.055***	0.055*	0.055*	0.067***	0.067***	0.111***	0.093***
Log durables	-0.077	-0.056	-0.100	-0.122	-0.166	-0.142	-0.622	-0.439
Log durables squared	0.024***	0.022***	0.027	0.028	0.031***	0.028***	0.075	0.058
Age	0.012	0.017	0.000	0.013	0.011	0.014	0.290*	0.269*
Age squared	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.003*	-0.003*
Primary education	0.203	0.219	0.188	0.194	0.274	0.285	0.759**	0.800**
Secondary education	0.437***	0.461***	0.425*	0.430*	0.503**	0.518**	0.750*	0.824**
Vocational education	0.334**	0.362**	0.327*	0.343*	0.484**	0.499**	0.986***	0.965***
College (2 year) education	0.341*	0.381**	0.332	0.365*	0.505**	0.531**	0.723	0.828*
University (4 year) education	0.691***	0.747***	0.706**	0.751***	0.709***	0.747***	0.721	0.775
Family size	0.031	0.029	0.025	0.018	0.062*	0.060*	0.044	0.054
Entrepreneur					0.132	0.143	-0.653	-0.536
Self-employed					-0.226	-0.225	-0.686*	-0.502
Employed in the private sector					-0.164	-0.154	-0.988**	-0.835**
Other jobs					-0.074	-0.056	-1.249	-0.964
Farmers					-0.372**	-0.360*	-1.459**	-1.317***
Unpaid job					-0.818**	-0.803**	-3.526**	-3.026**
Self-employed	0.077	0.079	0.090	0.081				
Unemployed	-0.295**	-0.297**	-0.284	-0.317				
Inactive	-0.321***	-0.310***	-0.276	-0.292				
Female	0.208*	0.200*	0.210*	0.193*	0.263*	0.264*	0.429**	0.362**
Homeowner	0.248*	0.283**	0.244	0.256	0.318*	0.341*	0.648***	0.616***
Other type of residence	-0.055	-0.012	-0.089	-0.034	0.163	0.186	1.799**	1.519**
Head of household	0.334***	0.316**	0.254	0.279	0.267*	0.259	2.691**	2.413**
Federation & urban	0.140	0.120	0.169	0.166	0.055	0.050	-0.429	-0.476
Federation & mixed	-0.072	-0.075	-0.065	-0.067	-0.138	-0.141	-0.508*	-0.477
RS & urban	0.366**	0.375***	0.357**	0.358**	0.382**	0.396**	-0.025	0.053
RS & mixed	0.106	0.116	0.089	0.107	0.080	0.089	0.186	0.172
RS & rural	0.122**	0.124**	0.121	0.159	0.120**	0.131**	0.640	0.497
Inverse Mills Ratio 1			-0.220	-0.336			2.944	2.836
Inverse Mills Ratio 2			-0.086	0.060			4.839*	3.064*
invmls1_2004 dummy				0.178				0.053
invmls2_2004 dummy				-0.047				0.097
Cons	5.707**	5.530**	6.333	5.944	6.347**	6.175**	-8.462	-6.559
Sample Size	867**	867**	867**	867**	584**	584**	584**	584**
F	17.730**		16.570		10.090**		9.99	
Root MSE	1.107**		1.109		1.104**		1.102	
Pseudo-R <sup>2</sup>	0.317**	0.317**	0.317	0.318	0.289**	0.289**	0.295**	0.296
Significance	0.000**	0.000**	0.000	0.000	0.000**	0.000**	0.000**	0.000
chi2		413.96		422.88		268.56		284.50

\*, \*\* and \*\*\* indicate significant level at 10, 5 and 1 percent respectively.

Table 12. Credit Market Participation: International Comparison of Empirical Estimations

	BiH	Italy	The Netherlands	UK	US	Hungary	Thailand
Age	Inverted-U shape with a maximum at 49	Inverted-U shape with a maximum at 35	Inverted-U shape with a maximum at 30	Inverted-U shape with a maximum between 20-30	Inverted-U shape with a maximum around 30	-	Inverted-U shape
Wealth	Inverted-U shape	Inverted-U shape	-	Negative relationship only for those with higher-than-median financial wealth	-	N/A	N/A
Income	Inverted-U shape	Inverted-U shape	+	+	Inverted-U shape	+	-
Education qualification	Inverted-U shape, although higher education dummy negative but not significant	No significant effect	No significant effect	+	+	+	Inverted-U shape
Unemployment	No significant effect	-	-	-	-	N/A	N/A
Other labor market status	Lower probability for inactive	Lower probability of mortgage demand for self-employed. No significant effect for consumer loans demand	No significant effect	Lower probability for self-employed, retired and students.	Lower probability for no paid job, retired and disabled.	N/A	Higher probability for farm operator and laborer
Female (Male)	No significant effect	No significant effect	No significant effect	+	No significant effect	N/A	N/A
Studies	Chen and Chivakul, 2008	Magri, 2002 and Crook and Hochguertel, 2005	Crook and Hochguertel, 2005	Del-Rio and Young, 2005	Crook, 2001 and Crook and Hochguertel, 2005	Arvai and Toth, 2001	Thaicharoen, Ariyapruchya and Chucherd, 2004

Table 13. Credit Constraint: International Comparison of Empirical Estimations

	BiH	Italy	The Netherlands	US	Thailand
Age	U shape with minimum at 48	Less constraints for age above 65	Less constraints for age above 50	Less constraints with higher age starting from age 30	-
Wealth	Inverted-U shape	- (Crook and Hochguertel, 2002) No significant effect (Magri, 2002)	-	-	N/A
Income	Inverted-U shape	-	No significant effect	-	-
Education qualification	No significant effect	Less constraints with high school education	No significant effect	Higher constraints with high school or college education	-
Unemployment (Employed)	+	No significant effect	No significant effect	No significant effect	N/A
Other labor market status	More constraint for inactive. Compared to those working for the public sector, working for the private sector, in unpaid jobs and farmer are more constrained.	More constraint for self-employed	More constraint for self-employed	More constraint for self-employed	Compared to unemployed, farm operator is less constrained while laborer is more constrained.
Family size	No significant effect	More constraint with higher number of children	No significant effect	More constraint with higher number of children	N/A
Female (Male)	No significant effect	No significant effect	No significant effect	-	-
Studies	Chen and Chivakul, 2008	Magri, 2002 and Crook and Hochguertel, 2005	Crook and Hochguertel, 2005	Crook, 2001 and Crook and Hochguertel, 2005	Thaicharoen, Ariyapruchya and Chucherd, 2004

Table 14. Amount of Desired Debt: International Comparison of Empirical Estimations

	BiH	Italy	The Netherlands	UK	US	Thailand
Age	No significant effect	Negative relationship. Significant especially for age beyond 40	Inverted-U shape	Inverted-U shape	Inverted-U shape	Inverted-U shape
Wealth	No significant effect	+ (Magri, 2002) - (Crook and Hochguertel, 2005)	-	Negative relationship only for those with higher-than-median financial wealth +	-	N/A
Income	U shape	- (Magri, 2002) Positive only at the highest income level (Crook and Hochguertel, 2005)	+	+	Inverted-U shape	U shape with a minimum around the 50 <sup>th</sup> percentile
Education qualification	+	+	Positive for university level	+	Negative relationship for completing high school. No significant effect for other education levels	+
Unemployment	No significant effect	No significant effect	No significant effect	-	No significant effect	N/A
Other labor market status	Lower for inactive, compared to employed. Lower for farmers and unpaid jobs, compared to employed in the public sector	Higher for self-employed	No significant effect	Higher for self-employed	Higher for self-employed	N/A
Family size	No significant effect	No significant effect for number of children	Positive relationship for number of children below age 6	Negative relationship for number of dependent children	+	+
Female (Male)	+	No significant effect	-	-	No significant effect	N/A
Studies	Chen and Chivakul, 2008	Magri, 2002 and Crook and Hochguertel, 2005	Crook and Hochguertel, 2005	Del-Rio and Young, 2005	Crook, 2001 and Crook and Hochguertel, 2005	Thaicharoen, Ariyaprichya and Chucherd, 2004



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<http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/0,,contentMDK:21485765~isCURL:Y~menuPK:4196952~pagePK:64168445~piPK:64168309~theSitePK:3358997,00.html>

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## Appendix

### Data Source

A Living Standards Measurement Study (LSMS) survey was conducted in BiH in 2001. This survey provides individual level and household level socio-economic data from 5,402 households drawn from urban and rural areas in the two entities of BiH, the Federation of Bosnia and Herzegovina (Federation) and the Republika Srpska (RS). The datasets are available on the World Bank's website:

<http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/0,contentMDK:21485765~isCURL:Y~menuPK:4196952~pagePK:64168445~piPK:64168309~theSitePK:3358997,00.html>

In 2002, 2003 and 2004, a sub-sample of the households interviewed in the 2001 LSMS were re-interviewed. The resulting panel data set is called "Living in BiH". These surveys were carried out by the State Agency for Statistics for Bosnia and Herzegovina, the Republika Srpska Institute of Statistics and the Federation of Bosnia and Herzegovina Institute of Statistics. The questionnaire include modules on demography, education, health, housing, labor, social protection, finances and credit, and migration. The 2001 and 2004 questionnaire also include modules on consumption, non-agricultural and agricultural activities. The sample was designed to be representative at the country level.

Living in BiH provides a rich source of information. Not only does it include questions on income and consumptions, but it also contain certain questions on household assets and liabilities. On the assets side, households are asked to report whether they are homeowners, and whether own a number of consumer durables ranging from refrigerator, television, and computer to car. They are also asked to provide the current prices of these items (what they think they would get if they were to sell those items). The value of their dwellings, however, was not recorded. On the liability side, questions on the amount of outstanding debt, the lending source, and the reason for not borrowing, were asked. Individuals were also asked whether they have attempted to borrow, but were refused, and who refused them.

We only use positive income individuals in the study, and we take out the top 1 percent outlier for income and debt.

## Variable Definition

Variable	Definition
Log income	Log of individual net income in KM, which includes labor income, transfer from government, private domestic transfer and private transfer from abroad
Log durables	Log of the value of household durables in KM
Log debt	Log of the amount of the most recent loan in KM
Age	Age in year
Family size	Number of individuals in the household
Education level dummies	A dummy equal to one if an individual finished a certain level of education, and equal to zero otherwise. The levels of education are no education, primary education, secondary education, vocational education, college (2 year) education and university (4 year) education.
Labor market status dummies	A dummy equal to one if an individual is in a certain group of labor market status, and equal to zero otherwise. The groups of labor market status are unemployed, employed by employers, self-employed and inactive.
Employment status dummies	A dummy equal to one if an individual is employed a certain type of job, and equal to zero otherwise. The types of job are public sector employee, private sector employee, self-employed, entrepreneur, farmer, unpaid jobs and other jobs.
Female dummy	A dummy equal to one for female, and equal to zero for male
Federation dummy	A dummy equal to one if the individual resides in the Federation, and equal to zero if residing in the RS
Republika Srpska (RS) dummy	A dummy equal to one if the individual resides in the RS, and equal to zero if residing in the Federation
Residence dummies	A dummy equal to one if an individual is in a certain type of residence, and equal to zero otherwise. These types are homeowner, renter and other (which include for example free stay and illegal occupant).
Urbanization dummies	A dummy equal to one if an individual resides in a specified area, and equal to zero otherwise. The areas are urban, rural and mixed.
Head of household dummy	A dummy equal to one if an individual is the head of household, and equal to zero otherwise

Source: Living in BiH Household Panel Survey.