The Demand and Supply for Household Debt: A Cross Country Comparison

Jonathan Crook
Credit Research Centre
University of Edinburgh

JEL:

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Address for correspondence: Management School and Economics, WRB 50 George Square, University of Edinburgh Edinburgh EH9 9JY, UK.
j.crook@ed.ac.uk
http:\\crc.ems.ed.ac.uk

Introduction

Economists have been interested of the demand and supply of household credit for many decades. However the volume of literature on these topics has expanded especially rapidly since the 1980's. The interest has been stimulated by developments in both micro and macro economics – the credit channel of the transmission mechanism (Bernanke and Blinder1988), Hall's (1978) modelling of the micro economic theory of the consumer using Euler equations and Stiglitz and Weiss' (1981) analysis of credit constraints. Moreover whilst most empirical work using micro data has related to the US, studies using microdata have also been carried out for Italy and to a smaller extent for the UK. Within Europe the EU is currently discussing Europe-wide regulations for the consumer credit market. However there has been no review of the comparative results of studies which have examined the demand and supply of credit across countries. It is therefore an opportune time to prepare such a comparison, which is the aim of this paper.

The structure of this paper is as follows. In section one I present some descriptive statistics concerning the possession and use of household credit; in section two I outline the rational expectations permanent income hypothesis (REPIH) theory of the individual's consumption choice. In the following sections I compare the results relating to household demand and supply of credit, respectively. In section five I review the methods which have been used to examine whether households are credit constrained and if so, the conclusions which may be drawn about the characteristics of such households. Section six concludes.

1. Cross Country Descriptive Statistics

Table 1 shows the incidence of household debt both in the form of mortgages and consumer loans. The data is drawn from several different sources and the definitions across countries are not identical. Nevertheless some general comments can be made. The proportion of households with any form of debt is considerably higher in North America, the Netherlands and Spain, with values of at least 66%, than in Australia, Japan and Germany with values around 40% - 50%. Italy has the lowest proportion of households with debt in the Table at only 19 %. The proportions of households with mortgages is similarly ranked, with around 43 % - 45 % having this form of loan in the US, The Netherlands, Spain and the UK, whilst only around 27 – 29 % of households in New Zealand and Australia have mortgages and a mere 9% of Italian households. Thirdly, around 49% of US and Spanish households have consumer loans with between 23% and 32 % of families in The Netherlands and Germany, and only around 13 % of households have consumer loans in the UK and Italy.

Table 2 shows the proportions of households with any type of debt by household characteristics. Whilst the categorisation of each characteristic is not identical across all countries, again the data are sufficient for some generalisations to be made. Looking at age the familiar life cycle pattern is apparent in each country with the proportions of households rising with age, reaching a maximum and then declining through to old age.

However, the proportions differ substantially between countries, as does the age of the head of household, or equivalent, at which holding debt is most common. Consistent with our earlier figures the incidence in Italy is much lower at all age groups than in the US, Canada the Netherlands and Japan. In the US the incidence is greatest when the head of household is aged 35 – 44 years whereas in Canada it is greatest at 25 – 34 years. Because of the different categorisation it is difficult to compare these with Italy where the greatest incidence is when the head of household is 31 – 40 years. However this is an earlier age than in Japan and The Netherlands where the greatest proportion of households holding debt occurs when the head is in his/her forties. Not only is the proportion lower in Italy than in the other countries but it decreases more rapidly as the head of household becomes older. The incidence amongst those aged 55 – 64 is only 46 % of that of those aged 31 – 40 years (the peak) in Italy whereas the incidence amongst those aged 55 – 64 is 85% of that of those aged 35 – 44 (the peak) in the US.

Turning to income, the incidence is almost 20 percentage points higher at each income decile in the US than in Japan and obviously much greater than in Italy. In the US and Japan incidence rises with income decile until the 90^{th} decide when it falls slightly. However in Italy the incidence above the 75^{th} percentile is lower than in the range 50^{th} – 74.9^{th} percentiles, whilst in the US and Japan the incidence is higher above the 75^{th} percentile than below it.

In the case of head of household work status, we can see that in the US the greatest incidence is amongst those working for someone else followed by amongst those who are self- employed. In Italy, the incidence is the same for both groups. The difference in incidence between those groups and those retired or not working is much greater for Italy, where it is only 31 % of that amongst those working, than for the US where it is between 51 % and 71 % of the largest value.

Finally the incidence with respect to net worth differs noticeably between the US and the Netherlands on the one hand and Italy on the other. In the US the incidence is greatest for those between the 25^{th} and 49.9^{th} percentile and decreases to be 87 % of this value in the 90^{th} – 100^{th} percentile. In Italy the incidence increases monotonically to the 75^{th} plus percentile group. In The Netherlands the incidence is highest in the upper two quartiles of net wealth.

Table 3 shows values of the total debt per household for those households who have debt only. Unfortunately for the US we only have the median value, whereas for Italy and Japan we have the mean. Since the distribution of debt is positively skewed within countries the median must be less than the mean. First note that not only is the proportion of Italian households who hold debt less than that in the US and in Japan, the mean value held by those who hold debt is also less than in the US. The median debt for the US is $38,800, in Italy it is €14,410. In all three countries the value of debt per household is monotonically related to income decile, although the relationship appears to be much steeper for the US than for Italy or Japan. In the case of age, the median volume of debt again shows the familiar life cycle pattern with the largest value occurring when the head of household is aged 35 – 44 years. In Italy the mean value of debt is greatest

when the head is 41 – 50 years whereas in Japan the largest value occurs at 30 – 39 years. In all three countries the value decreases quite sharply after age 50.

The self-employed have the greatest value of debt per household in both the US and Italy. The data for the US relates to any form of debt - including that which may be used for a business whereas that for Italy relates to debt only for personal use. The value of debt per household is also monotonically related to net wealth in both the US and Italy, although the relationship between the median and net wealth decile is much steeper for the US than is the relationship between the mean and net wealth decile for Italy. For example, the median value for those in the third quartile of net wealth in the US is 6.8 times the median value in the first quartile, whereas for Italy the corresponding figure for the mean value is just 2.06.

In conclusion Italy stands out from other Western countries as having a lower proportion of households with debt, those which hold debt hold a lower amount and the relationship between the value of debt per household and income, age and net wealth is less steep than in other Western countries.

The data considered so far show only univariate relationships and no attempt to explain the volumes of debt held by households has been made. To explain these volumes we need to consider the determinants of cross-sectional demand and supply.

2. Household Demand for Debt

Virtually all-empirical studies of the demand for debt assume explicitly or implicitly the REPIH of Hall (1978). In its simplest form it is assumed that individuals aim to choose the amount of consumption in each time period to maximise their utility subject to an inter-temporal budget constraint that the present value of consumption must equal that of income (assuming no bequests). It is also assumed that (i) consumption and leisure are additively separable, that is the utility function does not include the amount of leisure enjoyed; (ii) the utility function is separable intertemporily: the marginal rate of substitution of consumption in one period depends only on the consumption in that period – there is no habit persistence or disappointment loss aversion (Garcia et al: 1997); (iii) capital markets are perfect in the sense that consumers can borrow all that they wish, subject to their budget constraint at an interest rate which equals the lending rate; (iv) that individuals form their expectations rationally. This can be represented as:

$$\underset{C_t}{Max}\, E_0 \sum_{t=1}^{T} \left[1 \Big/ (1+\tau) \right]^t U(C_t) \qquad \ldots(1)$$

$$\text{S.t.} \qquad A_{t+1} = (1+r)A_t + Y_{t+1} - C_{t+1} \qquad \ldots(2)$$

$$C_t \geq 0 \qquad A_T \geq 0$$

where T = length of life
τ = time preference rate
r = interest rate
C_t = consumption
Y = labour earnings
A_t = non human assets at time *t*

The solution consists of Euler equations:

$$\frac{\partial U_t(C_t)}{\partial C_t} \Big/ \frac{1}{(1+\tau)}\left(\frac{E(\partial U_{t+1}(C_{t+1}))}{\partial C_{t+1}}\right) = \left(\frac{1}{1+r}\right) \qquad \ldots\ldots(3)$$

t = 1..T

If there were only two periods, 1 and 2, we could represent this condition diagramatically as in Figure 1. The left hand side of equation (3) is the marginal rate of substitution of C_{t+1} for C_t and is represented by the slope of the indifferent curve. The right hand side is the marginal rate of transformation of income in period *t* into income in period *t+1* and is represented by the (negative) of the slope of the budget constraint. In the figure the desired stock of debt in period 1 is $\left[C_1^* - (A_1 + Y_1)\right]$ where C_1^* is the desired value of consumption in period 1. In general the desired stock of debt equals $\left[C_t^* - (A_t + Y_t)\right]$. If one also introduces variables which affect utility into the utility function they will enter the expression for the desired stock of debt.

Most empirical studies (for example Duca and Rosenthal: 1993, Cox and Jappelli: 1993) which estimate models to explain desired debt do not assume a particular utility function and so estimate a reduced form directly.

Most empirical studies adopt one of two econometric methodologies. In one methodology a demand equation is estimated after two selection equations have been estimated. A household's desired or preferred level of debt is observed only for households that desire positive debt who also do not face binding borrowing constraints. We will give a more specific definition of a binding liquidity constraint later, but for our purposes a household faces a binding liquidity constraint if their desired stock of debt (D^*) exceeds the maximum amount lenders will lend to it (S^*) at current interest rates: $D^* > S^*$. The desired stock of debt at any time *t* is the volume which solves the utility maximisation problem at time *t* above. The standard model can then be written:

$$D^* = \beta_0' x_0 + e_1 \qquad \ldots(4)$$

Let I^*, be a continuous unobserved (latent) variable such that:

$$I_1^* > 0 \Rightarrow I_1 = 1 \text{ if } D^* > 0$$
$$I_1^* < 0 \Rightarrow I_1 = 0 : \text{otherwise} \qquad \ldots(5)$$

where I_1 is observable. I_1 therefore indicates whether a household prefers positive or zero debt and may be modelled as:

$$I_1 = \beta_1' x_1 + \varepsilon_1 \qquad \ldots(6)$$

The variables in x_1 include those in x_0, plus others which, for example, may affect the convenience and fixed costs of using credit.

Let I^*_2 be a second unobservable variable such that

$$\begin{aligned} I_2^* > 0 \Rightarrow I_2 = 1 \quad & \text{if household is not credit constrained: } D^* < S^* \\ I_2^* < 0 \Rightarrow I_2 = 0 \quad & \text{if household is credit constrained: } D^* > S^* \end{aligned} \qquad \ldots(7)$$

where

$$I_2 = \beta_2' x_2 + \varepsilon_2 \qquad \ldots(8)$$

The variables in x_2 include those in x_0 and those which would determine S^*, the maximum amount which institutions are willing to lend to the household. The selection equations allow four possible groups, as shown in Figure 2. Note however that in principle a household can be constrained (in the sense of wishing more debt than it can obtain) only if it desires debt and, if it does not wish any debt then it cannot be constrained. Therefore *in theory* sample $S_{\circ\circ}$ contains no cases.

Equation (4) is estimated for the S_{11} cases, correcting for biases which may be induced by the double selection mechanism. The expectation of desired debt is:

$$E\left(D^* \mid I_1 = 1, I_2 = 1\right) = \beta_0' x_0 + E\left(e_1 \mid I_1 = 1, I_2 = 1\right) \qquad \ldots(9)$$

Assuming $(\varepsilon_0, \varepsilon_1, \varepsilon_2)$ is distributed trivariate normal, Tunali (1986) showed that:

$$E\left(e_1 \mid I_1 = 1, I_2 = 1\right) = \sigma_{1\varepsilon 1}\lambda_{1\varepsilon 1} + \sigma_{1\varepsilon 2}\lambda_{1\varepsilon 2} \qquad \ldots(10)$$

where $\lambda_{1\varepsilon 1}$ and $\lambda_{1\varepsilon 2}$ are functions of $\beta_1' x_1$, $\beta_2' x_2$, and $\sigma_{\varepsilon 1\varepsilon 2}$, and $\sigma_{1\varepsilon 1}$ and $\sigma_{1\varepsilon 2}$ are given in Duca and Rosenthal (1993). If the covariance between ε_1 and ε_2 is zero, $\lambda_{1\varepsilon 1}$ and $\lambda_{2\varepsilon 2}$ collapse into Mills ratios: $\lambda(t) = \phi(t)/F(t)$ where $\phi(t)$ is the standard density function and $F(t)$ the cumulative standard distribution function evaluated at the probits in each case.

The equation which is estimated is:

$$D^* = \beta_\circ^{'} x_\circ + \theta_1 \lambda_{1\varepsilon 1} + \theta_2 \lambda_{1\varepsilon 2} + \eta \qquad \ldots(11)$$

where η is a normally distributed error and θ_1, θ_2 are parameters to be estimated.

The estimation takes place in two stages. First $\lambda_{1\varepsilon 1}$ and $\lambda_{1\varepsilon 2}$ are estimated from a bivariate probit which estimates equations (6) and (8), and then equation (11) is estimated. The inclusion of $\lambda_{1\varepsilon 1}$ and $\lambda_{1\varepsilon 2}$ allows for correlation between variables which are omitted from the x_0 vector (equation 11) and from each of the selection equations and so between variables which explain e_1, ε_1 and ε_2. The inclusion of $\lambda_{1\varepsilon 1}$ and $\lambda_{1\varepsilon 2}$ makes the estimates of $\beta_\circ$ consistent.

The second methodology involves estimating a demand equation, a supply equation and a rationing equation simultaneously (Grant 2001). If we write the demand and supply models as:

$$\begin{aligned} D^* &= f_1(x_1, \varepsilon_1) \\ S^* &= f_2(x_2, \varepsilon_2) \end{aligned} \qquad \ldots (12)$$

where the level of debt observed is min (D^*, S^*), a household is constrained if $D^* > 0$ and $D^* > S^*$. Equation (12) can be rewritten as:

$$D_i = f_{1i} + \pi_i (f_{2i} - f_{1i}) + \varepsilon_i \qquad \ldots(13)$$

where $(f_{2i} - f_{1i})$ indicates if a household is constrained, and D_i is the observed volume of debt. As Grant notes the sample selection studies assume that π_i is observed. When observing just those who are constrained $(\pi_i = 1)$ the supply function can be identified and when $(\pi_i = 0)$ the demand function can be identified. Given that only the minimum of D^* and S^* is observed, the demand and supply functions are estimated by assuming $\pi_i = f(x_1, x_2, \varepsilon)$ where ε is an error term. Therefore the model becomes:

$$D_i = f_{1i} + P(\pi_i = 1 \mid x_{1i}, x_{2i}, \eta)(f_{2i} - f_{1i}) + \varepsilon_i \qquad \ldots(14)$$

Identifying restrictions are imposed to identify the demand and supply functions.

The sample selection methodology has been used to estimate the demand for household debt functions for both the US and for Italy. The disequilibrium model only for the US. Table 4 summarises the results.

Two data sources have been used for the US: the Survey of Consumer Finance (SCF) and the Consumer Expenditure Survey (CEX), and for Italy the Survey of Household Income and Wealth (SHIW). The SCF consists of a multistage area probability sample of around 4,300 households throughout the US with high wealth households being over sampled. The over sampled cases can be identified and so removed from the 1983 survey, but not from subsequent surveys. Variables collected relate to all assets and liabilities. The survey is carried out by the Federal Reserve Board with the aim of measuring the wealth distribution of households. Information relating to whether a household is credit constrained is collected. The CEX is a rolling quarterly panel survey of US households with each household being interviewed for five successive quarters. Each household is then deleted from the sample and replaced. Data is collected on all household consumption expenditures and also on unsecured outstanding debts (debts on credit cards, store cards, bank debt, credit union debt, finance company debt, savings and loans debts, medical and other debts). The CEX had a larger sample (around 7000 households) than the SCF but it does not included direct questions relating to credit constraints. It is carried out by the Bureau of Labor Statistics with the aim of calculating weights for inflation indices. The SHIW is a biannual survey of Italian households carried out by the Bank of Italy. Like the SCF it is a multistage random probability sample. Data is collected on social and economic characteristics of household including real and financial assets, debts and income. It includes questions relating to credit constraints. From 1989 onwards an increasing proportion of households have been re-interviewed: 15% in 1989 to 45% in 1998. In all 3 surveys sampling weights equal to the inverse of the probability of a household being sampled are provided

Unfortunately there is no comparable data for the UK. The Family Expenditure Survey (FES) collects household level data on all types of expenditure over a 2-week period (the Diary) and some expenditures over a 3-month period. But it does not collect information on the stock of debts, or assets nor on credit constraints. It measures the amount of credit extended on credit cards in the Diary and some selected types of credit extended e.g.hire purchase over a 3-month period. The British Household Panel Survey (BHPS) contains data on amounts owed (in broad bands) on personal loans, credit cards and on hire purchase, but not on credit constraints. The Survey of Low Income Families (SOLIF) is a panel survey of lone parents, families with no one working more than 15 hours a week and of couples eligible for family credit. Data is available for amounts outstanding by type of debt, and whether a family is behind with repayments and by how much. The survey does not contain a measure of whether the household is credit constrained .

In Australia the Australian Bureau of Statistics conducts the occasional Household Expenditure Survey (the last being 1998-99). This collects data on sociodemographic variables and various types of debt. There are similar surveys in Canada, Japan, New Zealand and several Far East economies such as Korea and Thailand. However no empirical estimates of demand for debt functions for these countries are known of.

In some of the studies in Table 4 the estimated demand functions are a biproduct of an investigation of a slightly different question. A full interpretation of the results will take this into account.

Table 4 shows considerable variation in the determinants of demand and the marginal effects *within* countries as well as between countries. Consider first current household income. All of the studies find, both within the US and in Italy, separately, current income significantly influences the desired stock of debt, but within each country the studies disagree over its sign. In the US, Cox and Jappelli find a negative influence, Duca and Rosental, Gropp et al and Crook all find a positive effect which declines as income increases, especially rapidly in the case of Duca and Rosental (to become negative at the means). In Italy, Magri (2002) finds a negative effect, Fabri and Padula a positive effect. The elasticity found by Cox and Jappelli for the US, at – 0.37, is very similar to that found by Magri for Italy of – 0.32. On the other hand, an increase by $1 in Duca and Rosenthal, at the mean values of all the variables, decreases debt by $0.15 whereas in Fabri and Padula, a €1 increase in current labour income would increase debt by €0.15. Gropp et al and Crook find a 1% increase in income increases debt by 0.13% and 0.8% respectively. A positive effect may be due to higher current income families having a greater demand for housing than lower income families and possibility greater job security enabling such households to be more confident in smoothing consumption (Duca and Rosental). On the other hand, Magri argues that a negative effect may be due to high-income households in Italy using less debt to finance housing and consumer durable purchases.

One difficulty which may effect the interpretation of income and other variables is endogeneity. Age of head of household and household income, income and education, income and net wealth, income and whether unemployed and many other combinations are likely to be correlated to a significant degree making the interpretation of the coefficients problematic. In the case of income, this will affect all studies relating to the US. For Italy Fabri and Padula adopt a particularly parsimonious model compared with Magri and so may be less susceptible to this criticism. On the other hand, variables that Magri finds to be significant are not included in Fabri and Padula suggesting possible omitted variable bias.

The effect of net wealth (or total assets) is in all cases except Crook, positive. Duca and Rosenthal specifically construct their wealth variable to minimise simultaneity between debt and net wealth, but the other studies do not. In both countries it seems that the more collateral a household can offer the more it wishes to lever up its assets. Magri finds an elasticity of 0.26 for Italy, whereas Cox and Jappelli and Duca and Rosenthal find an elasticity of 0.78 and 0.15 for the US, respectively.

The level of education of the head of household also positively affects demand in both countries. Gropp et al find having a High School Diploma will increase desired debt by 0.12% in the US whereas in Italy Magri finds it will increase debt by 0.17%. Human capital may be expected to increase job security and increase expected future income so a greater willingness to smooth consumption.

The relationship between desired debt and age generally shows the familiar life cycle pattern in the US although this is not always so (Grant), but Magri does not find support

for this in Italy. In Italy the effect of age is not significant, though the sign is negative. In the US the commonly used spline functions take on increasing values of age if a head of household is within the specified range, and are zero otherwise. Therefore for the US it seems that increased age beyond the mid 30s will decrease demand whereas increasing age below the mid 30s will increase demand. Whether this effect occurs for those below 25 or below 35 is debated.

All studies (except for Grant) for the US find that being married has no significant effect on desired debt, having in most cases controlled for family size. In the US household size increases demand, whereas this is not so for Italy.

Some additional conclusions, which are not comparable across the two countries from the research to date may be drawn. First, in the US Gropp et al find that households in the top half of the asset distribution will increase their desired stock of debt when they can retain more of their assets if they go bankrupt, whereas less wealthy households would decrease their stock. This is also true if households in the States which have unlimited bankruptcy exemption. This is consistent with intuition: those with the most to loose in bankruptcy will benefit more by high exemptions. Gropp et al interpret the negative effect at low asset values as indicating a supply effect rather than an effect on desired debt. This is possible since there is ambiguity as to whether Gropp et al are modelling demand or merely the *ex post* volume of debt.

In related work Magri and Fabri & Padula consider the effects of enforcement costs on desired debt. Fabri and Padula build a theoretical model in which a consumer maximises utility over two periods with the possibility of borrowing in the first period and repaying in the second period, subject to two constraints. The first constraint is that the repayment expected by the bank, which depends on the liquidisable value of collateral, must exceed some minimum. The second is that the expected utility from repayment must exceed that from default. The incentive to default depends on the efficiency of the judicial system as does the expected receipts by the bank. Intuitively poor quality judicial enforcement of asset repossession in the event of default will raise the cost of liquidation by the banks, which will be passed on to borrowers as higher interest rates which will be expected to reduce desired debt. By including a variable to represent the efficiency of the judicial system in the region of Italy in which the household lives, Fabri and Padula show that actual debt possessed by unconstrained households is positively related to the efficiency of the judicial system. The elasticity of debt volume with respect to judicial system quality is 41-50%.

Magri also uses inter-regional differences to explain demand. Italian regions differ in the percentage of debt which is recovered (lower in the South than in the North) and the time taken for institutions to recover this amount (longer in the South than in the North). Including such variable in the desired volume of debt function she finds that the greater the share recovered, the greater the demand, but this is not true for recovery time.

3. Supply

There are few empirical studies which show cross-sectional debt supply functions explicitly; many infer the conditions of supply from demand functions and models identifying constrained households. One exception is Grant (2001) who used the methodology explained in Section 2 to estimate the volume of supply of credit functions for the US. However only two variables were found to be significantly related to supply : being married and having a college degree, both positively related to supply. Gender, age, number of children, interest rate and being non-white were not significant.

However there is a rapidly growing literature on credit scoring (see for example Thomas et al: 2002 and the special issue of the Journal of the Operational Research Society January 2001) and some papers show the household characteristics associated with the probabilities of default. A word of warning is in order. These models are designed to predict, subject to being 'statistically derived' and 'empirically valid' (as required by US law). In short, the covariates may covary significantly with each other. Nevertheless some generalisations can be drawn.

Boyes et al (1989), using a constrained bivariate probit model (accepted – rejected in previous model, and default – good since being granted a loan) to find that the probability of default is negatively related to age, and to being married, and positively related to the number of deposits and having some college but not a college degree. Being a homeowner is associated with a lower chance of default, a renter with a higher chance, a high expenditure: income ratio is positively associated with default. Having a major credit card reduces the probability of default, having a store card increases it. Particularly significant were items supplied by credit bureau: the number of inquiries or various derogatory accounts elsewhere were positively associated with little probability of default and having satisfactory accounts elsewhere was negatively correlated with probability of default.

Using the 1998 SCF Stavins (2000) modelled the probability htat a household was two or more months behind with any debt repayment. As in Boyes, age and being married, were negatively related to default. The number of credit cards and income, net wealth, debt: income ratio and years of education were also related. As with Boyes, family size was positively related.

Although the Boyes paper is well cited both of these papers yield very crude scoring models. Score card builders use much more flexible functions to predict default. Non linearities for each variable are allowed for, in some the probability of default is not even monotonically related to continuous variables (Crook et al: 1992, Desai et al: 1996). In general, models which are more closely allied to those of lenders find that in addition to bureau information, measures indicating household stability, such as years at address and years at current bank are negatively related to default. For example Crook et al (1992), using a sample of credit card holders, found these variables to be significant as well as employment category, residential status, spouse's income and having a phone.

There is an embryonic list of cross-country differences in the predictive ability of certain household characteristics. Platts and Howe (2004) considered data relating to the UK, Germany, Greece, Belgium and Italy. Not only are different variables collected and different nominal categories used in different countries, but the same variable sometimes has very different predictive power in different countries. For example, not having a home phone was more predictive in the UK than in other countries and having a bad credit bureau report was more predictive of default in Italy, Germany and the UK than in Greece.

It should be emphasised that whilst the selection of these variables is not based on a prior economic theory they are the types of variables which institutions actually use to decide who is granted credit and who is not.

Data from credit bureaux are used by the overwhelming majority of institutions that operate scorecards. However the availability of bureaux data differs considerably between countries. Jappelli and Pagano (1993) developed a theoretical model of the effect of information sharing facilitated by credit bureaux and the volume of credit extended.They argue that banks are subject to adverse selection because they have imperfect information with which to predict the riskiness of a borrower defaulting. Risky borrowers know this and apply. Jappelli and Pagano argue that by sharing information banks are able to lend to applicants about whom they knew nothing before the advent of bureau and so had, in that earlier state of knowledge, to be declined. But this may reduce lending if this effect is out-weighted by the decrease in credit awarded to applicants who, before information sharing, would have been granted it. Second, banks are subject to moral hazard because once a loan is granted, the bank cannot observe the effort made by the borrower to repay. Information sharing reduces the information rents that banks would otherwise earn because borrowers would be less likely to face interest rate hold ups since they can switch to other banks. Banks would have to charge lower rates and this reduces the probability of default and increases the volume lent compared with the the volume in the absence of information sharing. Furthermore, Padilla and Pagano (2000) argued that potential poor risks know that with shared information, a default at one bank will reduce their chances (increase the rate charged) at other banks. Without sharing, there is a lower chance this would happen. Default rates and interest rates are lower, resulting in greater lending. Alternatively, since banks loose information advantages over other banks it is possible they may be more cautious in lending. So lending is lower than without information sharing.

Jappelli and Pagano's empirical work is based mainly on questionnaires received from bureaux in 46 countries. It shows that in 1998 40 of the 46 had a credit register, either public or private. Noticeable absences were in Greece and Turkey.

Table 5 shows the content and population coverage of private and public credit bureaux as found by Jappelli and Pagano for selected countries. It is noticeable that in Spain and Denmark private bureaux exchange only black information (defaults) and that in Italy

only 5% of the population was covered by private bureaux in 1996, although a further 12% of the population were covered by public bureaux.

There is no evidence to indicate which types of household gain credit or are rejected, due specifically to the presence or absence of credit bureaux. However Jappelli and Pagano found evidence that, given the level of GDP, those countries with greater information exchange had larger values of bank lending relative to GDP.

4. Credit Constraints

Various definitions of liquidity constraints have been proposed. The following two definitions have been commonly adopted (Attanasio (1994) and Hayashi (1987)).

Strong definition:
"An individual or household is liquidity constrained if (s)he is unable for whatever reason to borrow against future earnings beyond a certain limit which can be positive or zero." (Attanasio 1994)

Weak definition:
An individual or household is liquidity constrained if the borrowing rate they face differs from the rate at which they can lend.

If the strong definition is adopted and the constraint is binding (the individual wishes to borrow more than the limit) then the Euler equation, equation (3), which describes an inter-temporal utility maximising individual, does not hold. If we consider a consumer who faces just two periods, as in section 1, the strong definition, if binding, can be represented as in Figure 3. WZ represents the budget constraint without liquidity constraints. With a maximum credit limit of $(A_1 + Y_1)$ to Y, the inter-temporal budget constraint is vertical at Y, and instead of the desired stock of debt of $(C_1^* - (A_1 + Y_1))$ the individual can gain only $(C_1' - (A_1 + Y_1))$.

The weaker definition is represented in Figure 4. Again the desired stock of debt is $(C_1^* - (A_1 + Y_1))$ but because the borrowing rate increases with the stock of debt the utility maximising stock is just $(C_1' - (A_1 + Y_1))$. In fact we could amend Figure 4 to incorporate binding constraints in different lending sectors each with a different rate (see Clayton, Sedgewick and Crook: 1978).

The empirical evidence concerning liquidity constraints has addressed two issues (a) do they exist and (b) if they do, which households or individuals are constrained.

At least four methods of addressing either question (a) or question (b) have been adopted. Here we will review each method dwelling on those for which there are internationally comparable results.

1. Excess Sensitivity Tests using Macrodata

Hall (1978) noted that if we assume a quadratic utility function such as $U(C_t) = -\frac{1}{2}(\bar{c} - C_t)^2$ where $\bar{c}$ is the bliss level of consumption, then substituting the first derivative into the Euler equation (Equation 3 above) we derive:

$$C_{t+1} = \phi + \theta C_t + \eta_{t+1} \quad \ldots.(15)$$

where $\phi = \bar{c}\left(\frac{r-\tau}{1+r}\right)$ and $\theta = \left(\frac{1+\tau}{1+r}\right)$ with η as a regression error.
The validity of the life cycle model is tested by parameterising:

$$C_{t+1} = f(C_t, x_t) \quad \ldots(16)$$

where x_t are variables other than consumption (such as income), and testing the null hypothesis that the parameter associated with x_t is zero. However as Attanasio (1994) remarks, this test is a joint test of all of the assumptions of the model (which we stated above) of which the absence of liquidity constraints is just one. These assumptions include some which Attanasio argues are implausible, for example that consumption and leisure are separable. These tests also assume that the proportion of consumers who are liquidity constraint over time is constant. In addition Attanasio and Weber (1993) show that inappropriate aggregation of data can result in income being significant in equation (16) and so explanations other than the existence of liquidity constraints are admitted by the data. Many other papers have adopted a similar methodology, for example Hayashi (1982), Campbell and Mankiw (1989) and others, all for the US.

2. Excess sensitivity tests using Microdata

If a household faces binding liquidity constraints then increasing current labour income in a period would result in increased consumption in that period because greater income gives the household more resources to dispose of than their permanent income. More formally, suppose we take the REPIH of equations (1) and (2) but allow for non-separability between constraints and leisure – so utility is a function of both – and we include a borrowing constraint. This formulation was adopted by Alessie, Melenberg and Weber (1988), and by Weber (1993). Adopting Weber's formulation (but assuming constrant prices for simplicity) the model is:

$$\underset{c_t l_t}{Max} \sum_{t=0}^{T} E\left[\frac{1}{(1+\tau)^t} U(C_t, l_t)\right] \quad \ldots(17)$$

S.t. $A_t = (1+r)A_{t-1} + Y_t + W_t(T - l_t) - C_t$ …(18)

$$t = o.....T$$

and a borrowing constraint: $A_t \geq L_t$ …(19)

where: l_t = leisure in period t
T = length of life
L_t = borrowing limit at time t
$A_{t=T}$ = 0 (no assets at death)

Forming the Lagrangian with a lagrange multiplier for the income constraint (equation 18) and a Kuhn-Tucker multiplier for the borrowing constraint (equation 19) and maximising with respect to C_t and l_t the following Euler equation is obtained:

$$\frac{\partial U(C_{t+1}, l_{t+1})}{\partial C_{t+1}} = \left[\frac{\partial U(C_t, l_t)}{\partial C_t} - \mu_t\right]\left[\frac{1+\tau}{1+r}\right] + \varepsilon_{t+1} \quad \ldots(20)$$

where $E(\varepsilon_{t+1}) = 0$ and μ_t is the Kuhn-Tucker multiplier for the borrowing constraint.

Many studies have adopted this type of formulation but without allowing for the non-separability of consumption and leisure (e.g. Zeldes: 1989) whereby the *l* just disappears from equation (20).

Assuming a specific utility function, typically one implying constant risk aversion, and substituting it into a version of equation (20) an equation is obtained similar to:

$$\log(C_{it+1}/C_{it}) = \alpha_\circ + \beta_i + \gamma'\Delta x_{it} + \delta_1 r_{it} + \varepsilon_{it+1} \quad \ldots(21)$$

where x_{it} is a vector of household characteristics which are expected to affect the marginal utility of consumption. This equation is then parameterised after including income (times a constant to be estimated), often as an instrument.

One common early methodology was to divide the sample of households into two groups: those expected to be liquidity constrained and those expected to be unconstrained, and to estimate equation (21) including an income term for each group. If the parameter on income was significant for the liquidity constrained group and not for the unconstrained group, this was taken as a violation of the REPIH due to the existence of liquidity constraints.

A comparison can be made between a UK study which adopted this approach and several from the US (Table 6). US studies have yielded conflicting results. Zeldes found that liquidity constraints existed, Runkle did not. For the UK, Davies and Weber (1991) using

FES data for 1972 – 1986, adopted a slightly different method. Splitting their sample they tested whether the parameters of a regression equation explaining consumption for those in the unconstrained group (where actual consumption equalled desired consumption) differed from the parameters of an equation estimated for the whole sample. They found that liquidity constraints existed for all years of their sample, but were declining, and they declined more in 1962 – 1980 than in 1980 – 1986.

Other US studies do not divide their sample into constrained and unconstrained groups, but again there is disagreement over the significance of constraints. Hall and Miskin (1982) find that credit constraints may apply to 20% of the population and only when interest rates exceed 20%.

However Attanasio (1994) has argued that the number of times a household appears in such panel data (many studies use the PSID) is typically not large. This implies that parameter estimates may lack consistency due to the error terms, including expectational errors, being correlated across households. Of course, these studies also fail to allow for non-separabilities between consumption and leisure.

3. Kuhn Tucker Multiplier Methods

To reduce the parameter consistency problem, and that of aggregation, some studies have used repeated cross-sections of households to construct pseudo-panel data. Some of these studies also allow for non-separability in the utility functions. One such study uses FES data for the UK. Weber (1993), following the model show as equations (17) to (19) above, assumes that L_t , the credit limit in equation (19), is positively related to labour earnings.

Equation (19) is thus reformulated and a new Euler equation to replace equation (20) is derived with a Kuhn Tucker multiplier for leisure, but not for a credit constraint. The Kuhn Tucker multiplier for leisure is observable and from it one can deduce whether households are constrained or not, unlike the lagrange multiplier for the credit constraint in equation (20). Weber found that each of four cohorts within this sample were liquidity constrained between 1972 and 1982 but not thereafter. Those where the head of household was born between 1934 and 40 were more affected in the1970s than those born during 1927 – 33.

Using a similar model to equations (17) – (19), Alessi, Devereaux and Weber (1997) assumed that a consumer's utility depended on consumption and the stock of durable goods to which (s)he had access and that consumption and leisure were separable. They also assumed that the credit limit depended on the value of durables (rather than income). Again, using FES cohorts and expenditure on cars, they found that the Kuhn-Tucker multipliers (indicating the significance of liquidity constraints) were close to zero throughout the 1970s and early 80s for those born between 1911 and 1940 (aged 39 – 60). But for those aged 29 – 33 the evidence suggested binding constraints existed in the late 1970s and for those aged 25 – 26 binding constraints were indicated for the early 1980s. Again, after 1982, no cohort appears to have been constrained.

Blundell et al (1994) also used repeated cross-sections from the FES and allowed for nonseparability in the utility function. They also allow demographic factors to affect inter-temporal expenditure. They found little evidence in support of excess sensitivity of income. This again calls into question the existence of liquidity constraints.

Brugiavini and Weber (1994) apply the same model as Alessi, Devereaux and Weber (1997) to the Italian SHIW 1987 data. The Kuhn-Tucker multiphier μ (adjusted by an inter-temporal price term), which shows the magnitude of credit constraints, is regressed on household demographics. Brugiavini and Weber find that being aged under 30, an owner occupier of housing, having a working wife, or a second job reduces the significance of credit constraints, whereas those aged 40-65, with kids aged over 20 or under 6, being married or having a large loan size are more credit constrained.

Using a similar methodology, Maccan, Rossi and Visco (1994) follow Maringer (1986). The individual is assumed to maximise a utility function - equation (17) subject to a borrowing constraint like equation (19). In this paper L_t, the minimum level of assets, indicates the minimum level of household equity in real assets. The constraint binds when household equity is below a cut off which Maringer shows occurs in the period which minimises current optimal consumption. Using this procedure they find the incidence of liquidity constraints to be as in Table 7.

These results suggest that those who experience liquidity constraints most are in their 30s and in very old age, female heads of household rather than male, and with less education. Dependant workers are more likely to be constrained than the self-employed and small and large families are more likely to be constrained than medium sized families.

However these results give no indication of whether the observed differences are statistically significant, and the utility functions adopted by Maccan assume separability between consumption and leisure.

3. Surveys

The above research was concerned mostly with whether constraints exist. The tests were typically of joint hypotheses, one of which was that liquidity constraints were absent. A much more direct method of gaining information on the *existence* of liquidity constraints and who is constrained comes from surveys. Both the US SCF, and the Italian SHIW contain relevant questions.

In every wave since 1983, the SCF has contained the following questions:

"In the past 5 years, has a particular lender or creditor turned down any request you or your (spouse / partner) made for credit, or not given you as mush credit as you applied for?"

"Were you later able to obtain the full amount you or your (spouse / partner) requested by reapplying to the same institution or by applying elsewhere?"

"Was there any time in the past five years that you or your (spouse / partner) thought of applying for credit at a particular place, but changed your mind because you thought you might be turned down?"

Combinations of the answers to these questions enable different groups to be labelled credit constrained. A common set of definitions (Jappelli: 1990, Crook: 1996, Cox and Jappelli: 1993, Jappelli, Pischke and Souleles: 1998, Ferri and Simon: 2002, Crook: 2001) involved labelling those who answer "yes" to the first two questions as 'rejected applicants' and those who answered "yes" to the third question but who did not fit into the rejected category as 'discouraged' applicants. Those households who were either rejected or discouraged were regarded as being credit constrained over the previous five years.

This definition is not universally accepted however, and several papers have explored the implications of alternative definitions. A second possible definition consists of those merely in the rejected group (Calem and Mester: 1995). This excludes the discouraged group.

Jappelli et al (1998) considered a definition which excluded from the first definition all households which reported having a credit card or a line of credit, on the grounds that possessing these facilities enabled them to gain at least some credit so they could not be facing binding credit constraints. A further empirical measure of credit constraints (definition four) is also adopted by Jappelli et al (1998) and consists simply of the absence of a credit card or line of credit. They argue this definition may be more applicable than the first and third definitions when parameterising models deduced from Euler equations because Euler equations relate to non-durable expenditure whereas the SCF questions may elicit answers relating to collaterized loans for durable expenditures. As Jappelli et al note this definition has the weakness that those who have a credit card may also be constrained if they have borrowed up to their credit limit and, secondly, those who have do not have a card may not be constrained, they simply desire not to borrow. Further definitions have been considered by Ferri and Simon (2002). They argue that since the interest rate on credit cards is higher than on most other types of loans those with positive credit card balances must have been unable to gain loans from cheaper sources. Their measures consist of (1) the possession of a positive credit card balance and (2) a positive credit card balance *or* no card (the latter may be unable to gain a card).

The Italian SHIW also asks similar questions to those in the SCF. The are (Magri 2002):

"In [year] did your household apply to a bank or a financial company for a loan or mortgage?"

"Was the application granted in full, in part or rejected?"

"In [year] did you or another member of your household consider the possibility of applying to a bank or a financial company for a loan or a mortgage but then changed his / her mind thinking that the application would be rejected?"

The first question restricted the loans applied for to consumer loans in the 1987 survey.

One obvious weakness of indicators of being credit constrained which use the above survey questions is that a household may apply for such a large loan that they have no realistic chance of repaying it. They would then be identified as credit constrained. This is even more problematic when discouraged borrowers are included. This calls into question the original and rather pragmatic definition of a credit constrained household, as stated earlier. On this definition perhaps everyone is credit constrained! Unfortunately there are no comparable question in surveys for any other countries.

Descriptive statistics showing mean values of demographic and financial characteristics of constrained and non-constrained households are also unavailable for Italy. However, Table 8 presents data for the US. On a univariate basis it would seem that those rejected or discouraged have considerably less wealth and family income and are younger than those who are unconstrained households A greater proportion of constrained households are non white, especially those who are discouraged from applying for credit, than the unconstrained. A greater percentage of those constrained are married than the percentage of those unconstrained. However, there is little difference in years of schooling or gender of the head of household.

These relative values were also found by Jappelli (1990) for 1983 where he also found that home ownership was much lower for constrained households than for the unconstrained.

Almost all models used to explain who is credit constrained follow that of Jappelli (1990). An individual is liquidity constrained if his / her desired stock of debt D_{it}^{*}, exceeds the amount that lenders are willing to supply, S_{it}^{*}. The desired stock of debt is the difference between desired consumption, C_{it}^{*} and available resources in the period, where available resources equal income Y_{it} plus assets in the previous period, A_{t-1} plus interest and desired consumption is that which satisfies the Euler equation without credit constraints (equation 3).

Thus

$$D_{it}^{*} = C_{it}^{*} - Y_{it} + A_{it}(1 + r_{it}) = \beta_1' x_{1it} + \varepsilon_{1it} \qquad \ldots(22)$$

where x_1 is a vector of observable variables which explain C^*, and Y, A and r. The reduced form of the supply of debt equation can be written:

$$S_{it}^{*} = \beta_{2it} x_{2it} + \varepsilon_{2it} \quad \ldots(23)$$

where x_{2it} is a vector of variables, used by financial institutions to decide whether to lend to a household I and if so how much, and where x_{2it} and x_{1it} may intersect.

Although we cannot observe D^* and S^* we could construct an indicator such that

$$I_{it} = 1 \ \ if \ \ D_{it}^{*} > S_{it}^{*} \quad \ldots(24)$$

0 otherwise

Where I_{it} is observable from the data in the surveys. Thus the empirical function which is estimated is

$$P(I_{it} = 1) = f(x_{1it} \cup x_{2it}) + \varepsilon_{it} \quad \ldots(25)$$

A logistic or probit density function is used for 'f'. Notice that the parameters in β_1, and those in β_2 cannot be separately identified for those variables where the same variable enters the demand and supply equations.

This methodology was followed by many studies using the SCF such as Jappelli (1990), Duca and Rosenthal (1993), Cox and Jappelli (1993), Crook (1996), Gropp et al (1997), Crook (2001). In some cases, equation (25) is one of a pair of bivariate probits where the other equation is the probability a household desires credit at all, and the equations are used as selection equations to remove omitted variable bias from a demand equation.

However, a slightly different means of identifying a credit-constrained household has been used in Italian studies. Magri (2002) rehearses the argument of Duca & Rosenthal that to be constrained a household must have a desire for positive debt. No wish to borrow precludes a household from being constrained. Therefore a second condition is introduced into equation (24):

a household is credit constrained ($I'_{it} = 1$) if

$$D^*_{it} > S^*_{it} \text{ and } D^*_{it} > 0 \quad \ldots(26)$$

However, she goes further, arguing $D^*_{it} > 0$ is necessary for identifying a household as being credit *unconstrained*. So

a household is not credit constrained ($I'_{it} = 0$) if

$$D^*_{it} < S^*_{it} \text{ and } D^*_{it} > 0 \qquad \ldots(27)$$

Therefore Magri estimates equations of the form of equation (25) only for households who asked for a loan. A weakness of this approach is that one would expect unobservable variables which affect whether a household desires a loan to be correlated with the unobservable variables affecting whether a household is constrained and so one suspects there may be selection bias. Magri notes that her results are very similar to a model established with a selection equation and indeed Fabri and Padula's models, which are established only for households who applied for a loan, were estimated with a selection equation.

Table 9 shows the dramatically smaller proportion of the total population which is rejected or discouraged in Italy compared with the US. We do not know if this is due to lax supply conditions or lack of demand but Fabri and Padula state that only 7.65% of households applied for credit in Italy and that 30% of those who applied were constrained. We know that the proportion of the population with debt is considerably lower in Italy than the US (Table 1). All this is suggestive that the cause is more on the demand side than on the supply.

Between the early 1980s and mid-1990s the use of formal credit scoring became more widespread in the US and probably in Italy too. Additionally changes in banking legislation in the US in the 1990s enabled holding banks to operate branches in many States. There followed a wave of banking mergers which has altered the competitive structure of the US retail loan market. These two factors may have altered the maximum amount of credit an individual with given characteristics could gain between the early 1980s and late 1990s. For these reasons we report the results for the 1980s separately from those of the 1990s.

The results of studies explaining the probability of being constrained in the 1990s are shown in Table 10. First notice that in Italy and the US current income is negatively related to the probability of being credit constrained. The marginal effect on the probability of being constrained for a $1 change in income is 0.1 percentage points for the US but only 0.0004 percentage points for Italy. Since demand for credit is positively related to income in Italy (Magri) and in the US (Crook 2001) this suggests supply increases more than demand. However, we must remember that those who believe they would be turned down are included in the measures of credit constraint. Therefore inferences about changes in supply relate to actual and *perceived* supply.

Second, the results for the US for wealth are conflicting: Ferri and Simon find a positive effect, Crook a negative effect. For Italy Fabri and Padula find a negative effect, Magri no effect. Theoretically, we may expect an increase in wealth would reduce lenders risk and increase their supply. Empirically wealth has a strongly positive effect on credit demand (Table 4) for both the US and Italy. The negative result, if accepted, would suggest the actual or perceived supply shift is greater than that of demand.

Age appears to have no effect on the probability of being credit constrained in Italy in the 1990s but it reduces the probabilities for households in the US. Credit scoring models (Banasik et al: 1996) show that age is negatively related to the probability of default and age is usually correlated with income until retirement. On the other hand demand decreases with age beyond the early 70s. Again it is difficult to calculate which effect is stronger.

Being married reduces the probability of being constrained in Italy, but not in the US. Being married has no effect on demand in Italy or the US (Table 4), which suggests that in Italy being married increases ones chances of gaining credit but not in the US.

Level of education appears to have no effect on the chance of being constrained in the US but the effect in Italy is unclear. Magri found that having a high school diploma reduced the chance of being constrained by 4.2 percentage points. Fabri and Pudula found having a diploma significantly increased the probability of being constrained. Notice that Magri also found that having a High School Diploma increased demand. This suggests the effect of supply exceeded that of demand if we accept her result, and vice versa if we accept Fabri and Padula's result. In the US education appeared to have little effect on demand (Duca and Rosenthal 1993, Crook 2001).

Household size and number of kids seems to increase the probability of constraints in both countries. On the whole number of kids generally increases the probability of default (Crook et al : 1992) and generally increases demand (Duca and Rosenthal: 1993, Crook: 2001). Both a demand increase and a supply reduction may explain this result.

We can also see the effects of features which have been investigated for one country but not the other. As in her demand functions, Magri investigates the effects of differences in the average recovery share of debt and recovery time in the region of Italy where the household lives on the probability of being constrained. She finds recovery share has no effect, but longer recovery time is positively related to the probability of being constrained. Given that recovery time was found to have no effect on demand, it is likely that it reduces supply. Financial institutions are more cautious when the costs of making a loan are higher. Notice however that the empirical variable only relates to mortgages, whereas the constraint questions in the SHIW relate to consumer credit also.

In the Ferri and Simon study variables which are typically predictive of default in credit scoring models: owns home, previous delinquencies, years at current address and years employed, enter with the correct signs and all but one are significant.

Turning to results from the 1980s, (Table 11) many US studies have modelled the probabilities of being constrained using the 1983 SCF because it identifies the State in which the respondent lives, contains Herfindahl values for bank concentration and because the over sampled high wealth group can be removed. For Italy the only known study (in English) is by Guiso, Jappelli and Terlizze (1996) using the SHIW for 1987. However, unlike Magri, and Fabri and Padula, the equation is estimated for a sample of the total population rather than only using cases who asked for credit. Whilst this aspect

makes the Italian and US studies more comparable in the 1980s than in the 1990s, (except for Duca and Rosenthal), another aspect counters this: the Italian study relates to consumer credit only, the US studies relate to consumer and mortgage credit.

A negative relationship with respect to current income was generally found in both countries in the 1980s, through not universally. Duca & Rosenthal's study of young households (head aged under 35) and Cox and Jappelli's study did not find this, even though Japelli's earlier study (Jappelli: 1990) did.

The ambiguous sign on net wealth for the US in the 1990s is also shown in results for the 1980s. Jappelli and Ferri and Simon find a positive relationship, Cox and Jappelli a negative one and in Duca and Rosenthal it is not significant. The Duca and Rosenthal model differs from the others in several respects. Not only is the sample of young families with wealth below $1M, but it is the only study which accounts for the possible simultaneity between wealth and being credit constrained, it is the only US study for which the credit constraint equation is established for debt holders only, and it is part of a *constrained* bivariate model (the other model being an index of positive debt holding). In addition it includes more variables which would be used in credit scoring models than many other studies. Many of these aspects give the model advantages over others although the nature of the sample calls into question how representative the results are for the whole population. Unfortunately the Italian study omits wealth.

In the 1980s the negative effect of age is also found in the US, but in Italy unlike the 1990s study, Guiso et al find a negative result. It is not clear if this difference is due to a change in bank policies over time, or a difference in policies between mortgages and consumer credit or a difference in *perceived* policies.

The absence of being married as found in the 1990s studies for the US, is entirely consistent with that in the 1980s. This was not included in the Italian study for the 80s.

In the 1980s the more educated were less constrained than the less educated in Italy, (as was found by Fabri and Padula for the 1990s but the opposite to that found by Magri). Given than education increases demand in Italy, it would seem the affect of education on real or perceived supply exceeds that on demand. As in the 1990s education has no detectable effect on being credit constrained in the US.

In the 1980s gender had no effect on the probability of being constrained – as in the 1990s. Since the Equal Credit Opportunities Act 1976 forbids the use of gender in credit scoring models in the US and since gender has no detectable effect on demand, this result is expected. In Italy being female increased the probability of being credit constrained in the 1980s in the consumer credit market. This variable was not included in the study for the 1990s. If households with a female head had had lower income than male headed households they would demand more credit (Magri in Table 4) and this may possibly acount for this result. In the US gender did not affect demand.

As in the 1990s, in both countries in the 1980s, the household size (or number of children) increases the chance of being credit constrained.

Certain issues have been investigated in one country rather than others, especially using 1980s data. One of the strongest and most consistent of results in all US studies is that being non white increases the probability of being credit constrained. But race does not appear to affect credit demand. Some researchers have suggested that this means that, having controlled for other factors which may affect default risk, non whites are given less credit. This result was also found using the 1995 SCF. Before policies are devised to deal with this issue the effects of collinearity need to be explored if possible. Also there is evidence that minorities are discouraged from applying (Crook: 1999), and as remarked earlier, discouraged households enter the definition by being credit constrained.

4. Switching Regressions

Two types of switching regression models have been used to yield information on credit constrained households, but both have been applied only to US data. Garcia et al (1997) note that by inserting an appropriate utility function into equation (20) an Euler equation of the following form can be derived:

$$\Delta C_{it} = \alpha + \beta \mathrm{X}_{it+1} + \pi_{1t} + e_{it+1} \qquad \ldots(28)$$

where π_{it} is an expression involving the Kuhn Tucker multiphier μ_t (in equation 20). Remember that if no constraint exists, μ is zero. Therefore two versions of equation (28) can be written: one for the constrained sample and one for the unconstrained sample:

$$\Delta C_{it+1} = \alpha_u + \beta \mathrm{X}_{it+1} + \delta_u Z_{it} + W_u \varepsilon^u_{it+1}$$

$$\Delta C_{it+1} = \alpha_u + \beta \mathrm{X}_{it+1} + \delta_c Z_{it} + W_c \varepsilon^c_{it+1} \qquad \ldots(29)$$

where Z_{it} is a parameterisation of the shadow cost of liquidity constraints. The likelihood function for ΔC_{it+1} involves a weighted sum of the densities of ΔC_{it+1} where the weights are the probabilities of being constrained (a logistic function).

The second method was used by Grant (2001), as explained in section 2. Both studies use the CEX, Garcia et al for 1980-87, Grant for 1988-93. Garcia found that the probability of being credit constrained is negatively related to income and owning a home with a mortgage – both being consistent with the survey results of Tables 10 and 11. Unlike the survey results, being married was found to reduce the chance of being constrained as was owning a car. Being non-white, as in all the survey studies, increases the chance of being constrained. Grant's results are expressed as the proportion of households which are constrained in various demographic categories, but it is difficult to appreciate if differences between categories are statistically significant. The impressions given are that being married, being younger, being better educated, being white and

having no children will increase the chances of being constrained. Many of these findings conflict with many other studies. However, Grant's work may be subject to criticisms concerning the ability of his identifying restrictions to ensure demand and supply are identified.

5. Conclusion

The incidence of mortgage holdings is greater in the US, Netherlands, Spain and the UK than in Australasia and Japan, with Italy have a lower incidence still. The proportion of households with consumer loans follows a broadly similar pattern, although the UK falls into the low proportion category. Debt holdings by age follow the life cycle pattern in all of the countries observed, although the age range where the incidence and volume of debt peaks differ between countries. In Canada the incidence peaks at an earlier age than in the US. Italy follows, with incidence reaching a maximum latest in the Netherlands and Japan. The incidence decreases more rapidly as age increases in Italy than in the US. Unlike other countries, the incidence of holding debt decreases at very high income deciles in Italy. In addition the volume of debt held is much lower in Italy than in other countries.

Studies which have estimated equations to explain inter-household differences in demand and the characteristics of households that are most likely to be credit constrained have been published only for Italy and the US. This is probably due to lack of data as to which households are credit constrained. Those studies that exist show considerable variation in the determinants of demand and in marginal effects within countries as well as between countries. For instance the effect of current labour income on demand has been found to have positive and negative effects in each of the two countries. Plausible explanations can be given to justify each finding. The effects of net wealth and of education both appear to be positive. The lifecycle relationship exists for the US but has not been found for Italy. Greater protection in the event of bankruptcy increases the demand for debt for those in the top half of the wealth distribution in the US. In Italy demand is greater in regions with a more efficient judicial system which probably lowers the costs of borrowing. Cross-sectional supply functions have been estimated only for the US and so cannot be compared across countries. Studies of credit scoring models rarely include estimated parameters. Those that do indicate measures of stability reduce the probability of default. Details of previous defaults – credit bureau data – are always very predictive of default, but are not related to the probability of default by an economic theory in which an economic agent optimisies. Evidence shows greater variation in the availability of credit bureau data between countries.

A variety of methods have been used to test for the existence of credit constraints. Studies which try to identify household characteristics which are correlated with being credit constrained have been published mainly for the US and Italy, although Weber found that the significance of credit constraints varied differentially between age cohorts during the 1970s and early 1980s in the UK.

The most recent studies suggest that the probability of facing actual or perceived credit constraints is lower for higher income households both in Italy and in the US, but with a much lower elasticity in Italy than in the US. The estimated effect of net wealth is unclear in both countries. Age appears to reduce the chance that a household is credit constrained in Italy, but has no independent effect in the US. Being married reduces the chance of being constrained in Italy but not in the US. Greater education appears to have no independent effect in the US, whereas in Italy conflicting results have been found. Household size and number of children increase the probability of being constrained in both countries. Studies for the 1980s broadly confirm those for the 1990s for both countries, albeit with a few exceptions. For the 1980s, older heads of households in Italy appear to have a lower chance of being constrained (age had no effect in the 1990s). In addition have being a female head of household in Italy in the 1980s increased the probability of being constrained, but was not investigated for the 1990s.

Overall a large number of further research questions are raised by these studies. We need to have measures of whether a household is credit constrained for many more countries. We need to investigate the collinearity between variables included and to try to standardise the variables used across countries, so comparisons can be made. There needs to be more research to explain the observed differences between countries especially between Italy and other countries.

Table 1

Incidence of Household Debt

	Financial Liabilities as a percentage of GDP	Proportion Of Households With Debt	Proportion Of Households With Mortgages	Proportion Of Households With Consumer Loans
CANADA		68	35	
US	76.0	75.1	44.6[1]	48.5
JAPAN	2 person households	51.4	33.7[2]	
	1 person households male	38.0	11.9[2]	
	1 person households female	22.2	4.9[2]	
AUSTRALIA	-	46.3[3]	-	
NEW ZEALAND	-	-	29	
FRANCE	46	-	-	
GERMANY	74	42.9	27.2	22.5
ITALY	30	19.1	9.0	12.2
SPAIN	56.0	74.3	43.1	48.5
NETHERLANDS	-	65.7	42.6	32.0
UK	77.0		31.8(45)	14.2

Sources:

Australia: Australian Bureau of Statistics: *Australian Social Trends 2002*
Income and Expenditure data from ABS: *1998-9 Household Expenditure Survey*
Canada: Net wealth Table 3.10a from *Survey of Financial Security 1999*
US: Aizorbe et al *Federal Reserve Bulletin* January 2003 from SCF 2001 and Magri (2002). Col 2 refers to 2000, cols 3 and 4: 2001, 5: 1998
Japan: *National Survey of Family Income and Expenditure 1999*
New Zealand: *Household Savings Survey 2001*
France: Magri
Germany: Magri
Netherlands: Magri
UK: Magri
Spain: Magri

[1] Mortgages home secured debt: mortgages, home equity loans and lines of credit secured on primary residence.
[2] Liabilities to buy houses or land
[3] Excluding credit cards.

Table 2

Percentage of Households with Debt by Sociodemographic Characteristics

	US 2001[1]	Italy 1998[2] Percentile of income		Canada[3] 1999		Japan[4]			The Netherlands[7] 1997	
Percentile of income	**Any debt**					**Percentile of income 2person households only**				
<20	49.3	<25	9.6			<20		32.4		
20-39-9	70.2	25-49.9	18.4			20-39.9		46.7		
40-59-9	82.1	50-74.9	25.9			40-59.9		55.7		
60-79-9	85.6	≥ 75	25-4			60-79.9		61.7		
80-89-9	91.4					80-89.9		62.2		
90-100	85.3					90-100		62.1		
Age –HoH							**Single person M/F**	**Single/ ≥ 2 person h/h**		
<35	82-7	≤ 30	19.1	<25	67	<30	34.7/27.7	49.3	<30	66.5
35-44	88.6	31-40	20.3	25-34	84	30-39	46.2/39.6	61.2	30-39	72.6
45-54	84.6	41-50	16.4	35-44	81	40-49	52.9/46.8	67.4	40-49	77.0
55-64	75.4	51-65	9.4	45-54	77	50-59	50.5/29.0	57.4	50-59	74.0
65-74	56.8	>65	2.2	55-64	62	60-69	21.4/15.8	32.5	60-69	54.5
≥ 75	29.2			≥ 65	27	≥ 70	12.3/11.8	19.0	≥ 70	28.3
Work status HoH										
Working for someone else	86.5		29.1							
Self-employed	81.7		29.2							
Retired	44.3		9.1							
Other not working	61.5									
Percentile of net worth		**Percentile of net worth**							**Percentile of Net Worth**	
<25	68.7	<25	17.0						<25	62.6
25-49.9	80.8	25-49.9	17.8						25-49.9	37.8
50-74.9	77.9	50-74.9	20.3						50-74.9	81.7

75-89.9	74.9	≥ 75	21.6						>74.9	80.7
90-100	70.2									

1 Aizcombe et al using data from the SCF 2001
2 Magri using data from the SHIW 1998
3 Net Worth 1999 using data from the *Survey of National Security* 1999
4 *National Survey of Family Income and Expnditure* Table 25
5 *National Survey of Family Income and Expenditure* Table 35
6 *National Survey of Family Income and Expenditure* Table 26
7 Alessie et al (2002)

Table 3

Mean and Median Values of Household Debt by Sociodemographic Characteristics

	US 2001[1]	ITALY 1998[2]		JAPAN 1999	
	Median values $000	**Mean values €**		**Mean values 000 ¥[3]**	
	Any debt				≥ 2person house holds[4]
Total	38.8	14410			11039
Ppercentile income					
<20	5.2	<25	9153	<20	4485
20-39.9	11.5	25-49.9	10800	20-39.9	8388
40-59.9	29.1	50-74.9	14940	40-59.9	10400
60-79.9	62.3	≥75	19330	60-79.9	12143
80-89.9	96.8			80-89.9	12847
90-100	146.4			90-100	18890
Age of Head of household					
<35	24.9	≤30	9005	<30	6349[5]
35-44	61.5	31-40	15023	30-39	12690[5]
45-54	54.3	41-50	17289	40-49	12537[5]
55-64	34.6	51-65	13922	50-59	10036[5]
65-74	13.1	>65	8029	60-69	8423[5]
	5.0			≥75	9208[5]
Work status of Head of household					
Work e.g. for someone else	42.5		13733		
Self employed	77.8		20878		
Retired	9.8		8853		
Other: not working	33.8				
Percentile net worth & net wealth					
<25	8.8	<25	6899		
25-49.9	38.5	25-49.9	13973		
50-74.9	60	50-74.9	14241		
75-89.9	80.3	≥75	21459		
90-100	126				

1 Aizaube et al using SCF 2001 – Median for families holding debt.

2 Magri (Table 4) using SHIW 1998 – Mean for families with debt.

3 Assume it's the mean per household. *National Survey of Family Income and Expenditure 1999*

4 Computed from Table 25 *National Survey of Family Income and Expenditure 1999*

Table 4
Household Models of the Household Demand for Debt

	Cox & Jappelli		**Duca & Rosenthal**	**Gropp,Sholz, White**	**Crook**	**Grant**	**Magri**	**Fabri & Padula**
	SCF 1983		**SCF 1983**	**SCF 1983**	**SCF 1995**	**CEX 88-93**	**SHIW 89-98**	**SHIW 1998**
	HoH<35yrs, Net wealth < $1m		All	All	All	HoH 25-55 with education, exclus	All	All
N(demand/Total)	2111/3691		710/1224	2118/3706	1947	13918	1949	1271
Dep Var	HHDebt[$]		HHDebt[$000]	log(HHDebt[$])	log(HHDebt[$])	HHDebt[$000]	log(HHDebt[£])	HHDebt[£]
	Elas	**Coeff**	**Coeff**	**Coeff**	**Coeff**	**Coeff**	**Coeff**	**Coeff**
Permanent Earnings	0.47	0.423*						
Current Income	-0.37	-0.29*	1.03*	0.14*	2.64*		(log) -0.32*	0.15*
Net Worth	0.78	0.23*			-0.01*		(log) 0.26*	0.03*
Wealth(fitted)			0.12*					
Income Squared			-0.003	-0.004*	-0.87*			
Pension x Inc			0.13				Ret inc 0.12	
Education			2.97					0.39*
Male			3.35	0.15	0.2			
Female	0.01	437				0.68*		
Age within ≤ 25	2.29	2370		0.13*	0.07	Age -0.32	} -0.12	
Age within 25-34	0.33	993*		-0.006	-0.03	AgeSq -0.11		

Age within 35-44	-0.23	-1040*				-0.04*		-0.02		Age^3 -0.15					
Age within 45-54	-0.24	-1822*				-0.04*		-0.01							
Age within 55-64	-0.04	-645				-0.05*		-0.10*							
Age within > 65	-0.03	-1285*				-0.06		-0.15*							
Married	-0.1	-3405		1.93		0.02		-0.1		2.56*		-0.06			
Risk averse				-1.56				-0.23*							
Att Consumption				-4.2											
Att Luxuries				4.65*											
Att Durables				5.87											
Att Emergency				-0.02											
Att General						0.02									
Non White	0.01	3149		-5.23		0.15		ns		-2.58*					
HH size	0.13	1050		2.69*		0.12*		0.15*							
Self employed												0.32*			
Justice														-22.78*	
High School Dip						0.12				4.09*		0.17*			
Some College						0.4*				4.74*					
College degree						0.52*		0.22*		5.00*					
Total assets						0.28*									
N East						-0.67*									
Mid West						-0.43*									
South						-0.58*									
Rural						0.02									
Herfindahl						-0.10*						-0.04			
Yrs current empl						-0.02*									
St wide br bankg						-0.009									
No multibank						-0.02									
County unempl						0.001									
Bank*D1						-0.053*									

Bank*D2						-0.22*							
Bank*D3						0.08*							
Bank*D4						0.16*							
Unlimbank*D1						-1.16*							
Unlimbank*D2						-0.17							
Unlimbank*D3						0.58*							
Unlimbank*D4						0.75*							
# inc earners											0.16*		
# children										Ns	0.07		
High risk infl inv											0.02		
Centre Italy											-0.11		
South italy											0.004		
Loan int rate										0.12	-0.07		
Recovered share											0.01*		
Recovery time											0.002		
Owns home								1.97*					
Exps rate rise								0.08					
Exps rate fall								0.05					
Foresees exp								0.30*					
Working								0.48*					
Unemployed				-060*									
Lamda not cons	-20442*			23.19		-1.54*		-2.16*			-2.2		-10.89*
Lambda + debt	10103			6.24		-0.25		1.68*			-0.15		
Constant	-47486					6.47*		6.53*		-7.56*	3.24*		7.05*

1. (Age – 40)/10
ns = not significant at 5%

Table 5

Availability of Credit Bureaux Data (Selected Countries)

COUNTRY	PRIVATE			PUBLIC		
	Available	**Type of information shared**	**Percentage of population covered**	**Available**	**Type of information available**	**Numbers of people covered (date)**
AUSTRALIA	Y	B&W	34(1990)	N		
UK	Y	B&W	105(1989)	N		
GERMANY	Y	B&W	59(1996)	Y	L, G	1.2
ITALY	Y	B&W	5(1996)	Y	D, A, L, G	6.5(1994)
FRANCE	N			Y	D, A	0.4(1990)
IRELAND	Y	B&W	23(1996)	N		
GREECE	N			N		
SPAIN	Y	B	N/A	Y	D, A, L, G	4.6(1990)
DENMARK	Y	B	50(1996)	N		
US	Y	B&W	228(1997)	N		

L = Loan exposure
D = Defaults
A = Arrears
G = Guarantees

Source: Jappelli and Padano (2002) Table 1 & 2

Table 6
Excess Sensitivity Tests using the Sample Splitting Technique

	Splitting Criterion	**Evidence consistent with credit constraints?**
US		
Zeldes (1989)	Non-housing assets/income	**Yes**
Runkle (1991)	Owned residence or Asset income > 2 months income	**No**
UK		
Davies and Weber (1991)	k_1*disposable income + k_2* wealth > K	**Yes**

Table 7
Percentage Of Households Who Were Predicted To Be Liquidity Constrained In Italy 1987

Overall			27.6
Age of Head of Household	<31		16.5
	31-45		34.1
	46-60		21.5
	61-75		27.0
	> 75		38.9
Sex of Head of household	Male		24.8
	Female		36.6
Education of Head of household		None	39.2
		Primary School	32.6
		High School	32.3
		Diploma	16.8
		University	11.6
Occupation of Head of household		Self employed	25.1
		Depended worker	30.1
Household size		1	42.3
		2	25.3
		3	22.4
		4	26.8
		≥ 5	28.1

Source: Maccan et al Table 9.4

Table 8
Mean Values (weighted) SCF 1989

	Rejected	Discouraged	Unconstrained
Net wealth [$000]	55.14	49.80	198.77
Total family income [$000]	28.16	25.98	41.79
Age of HoH	37.96	38.42	50.27
Gender of HoH(Male)	0.72	0.63	0.72
Marital Status of HoH	0.49	0.46	0.57
Years of schooling HoH	12.62	12.04	12.49
HoH is not white	0.35	0.51	0.21
Currently working for pay HoH	0.80	0.71	0.65
Family saves	0.50	0.41	0.65
Percentage of (weighted) cases	11.7	8.7	79.6

Mean values are calculated using all 5 implicates
Source: Crook (1996)

Table 9

Credit Constrained Households as a Percentage of the Total Population

	US	**US**	**Italy**
	1983-86	**1989, 92, 95, 98**	**1989, 92 95**
Rejected or Discouraged	14.4	22.6	2.44
No credit card or line	23.7		
Low assets	62.1		
Source	Jappelli, Pischke, Souleles (1998)	Ferri and Simon (2002)	Fabri and Padula (2002)

Table 10

Models of Probability a Household is Credit Constrained in the 1990s

Country and Date	**Italy 1989-93-95 SHIW**	**US 1989,92,95,98 SCF**	**Italy 1989,95,98 SHIW**	**US 1995 SCF**
	Marginal Effects	**Marginal Effects**	**Sign and signif**	**Sign and signif**
Sample	HH who have applied for a loan	All HH	HH who have applied for a loan (with selection equation)	$1≤income<$300 k & assets < $1m
Author	Magri (2002) T11	Ferri & Simon (2002) T6	Fabri & Padula (2001) T5	Crook (2001) T2a
Income	(£m) -0.002*	-0.0012*	- *	- *
Income squared				ns
Permanent Income		-0.0009*		
Net Wealth	(£m) 0.000	0.00004*	(collateral) - *	- *
Retirement Income	-0.041			
No income earners	0.014			
Liabs/assets		0.1543*		
Liq assets/liq ass+ bonds + shares		0.0112		
Delinquent		0.1572*		
No finl institutions hh interacts with		0.0125		
If ccard & checkg with same bank		-0.0263		
Homeowner		-0.0937*		- *
Self employed	0.054*			
Age	0.001	-0.0049*	ns	
Age squared			ns	
Age within < 25				ns
Age within 25-34				ns
Age within 35-44				ns
Age within 45-54				ns
Age within 55-64				- *
Age within ≥ 65				- *
Male		0.0427		ns
White		-0.0928*		
Black				+ *

Married	-0.074*	-0.0055	- *	ns
High School Dipl		0.0031	+ *	
High school edn	-0.042*			
College degree				ns
HH size		0.0175*	ns	+ *
No children	0.021*			
Yrs employed		-0.0016*		
Yrs at job				ns
Unemployed			+ *	
Working				ns
Retired			ns	
Yrs current address		-0.0014		
At address < 2 yrs		0.0327		
High risk in fin inv				
Munic < 20k inhabs	0.003			
Centre	[0.038]			
South	[0.128]*			
Herfindahl	-0.118			
Loan interest rate				
Recovered share	0.000			
Recoverey time	0.002*			
GDP per capita			ns	
Judicial inefficiency			+ *	
Occupn dummies				ns
Expects rate rise				ns
Expects rate fall				ns
Foresees maj expd				+ *
Risk averse				ns
No of cards				- *
Regional dummies				ns
Cheque acct				ns
% HH constrained in sample		22.59	30	
% HH constrained in population		22.59	2.44	
			Corrected for clustering and weighted	Robust standard errors and weighted
Sample size	1287	2273-2940	1870	3199

- = significant at ≤ 5% (Magri, Fabri and Padula, Crook)

= significant at ≤ 5% in 3 out of 4 years (Ferri and Simon)

Table 11
Models of Probability a Household is Credit Constrained in the 1980s

Country and Date	**US 1983**	**US 1983**	**US 1983**	**US 1983**	**US 1983**	**Italy 1987**
Author	**Gropp et al (1997) TII**	**Jappelli (1990) TIII**	**Ferri & Simon (2002) T6**	**Cox & Jappelli (1993) T2**	**Duca & Rosenthal (1993) TII**	**Guiso, Jappelli & Terlizze (1996) T4**
Sample	All HH	All HH	All HH	Wealth < $1m	HoH < 35yrs & wealth < $1m	All HH
	Marginal Effects	**Marginal Effects**	**Marginal Effects**	**Sign & signif**	**Sign & signif**	**Sign & signif**
Income	($0000) -0.032*	+ * -0.055*	-0.0011*	ns	ns	-*
Income squared	($00m) 0.0006*	- *			ns	
Permanent Income			-0.0007	ns		
Net Wealth		+ * 0.015*	0.0001*	- *	ns	
Net Wealth squared		ns		ns		
Wealth * income		- *				
Total assets	-0.033					
Debt		0.003				
Liabs/assets			0.0456*			
Liq assets/liq ass+ bonds + shares			0.0291			
Delinquent			0.1105*		+*	
No finl institutions hh interacts with			-0.0024			
If ccard & checkg with same bank			-0.0307			
Homeowner		-0.046	-0.0896*	-*	-*	

Age	(00yrs) 0.0118	ns	-0.005*	-0.0051*	ns	-*
Age squared	(0000yrs) -0.617*	- *		ns		
Female	-0.003	-0.007	0.0041	ns	ns	+*
NonWhite	0.087*	0.054*	0.0715*	+*	+*	
Married	-0.057*	-0.034	-0.0268	ns	ns	
Education	-0.0007	-0.0003	0.0018		ns	-*
HH size	0.010*	0.011*	0.0068	+*	ns	+*
Yrs at job	-0.004*		-0.0041*		ns	
Unemployed		0.027		ns	ns	+*
Full time				ns		
Part time				ns		
Recg public assist					+*	
Recg pension						ns
Yrs current address			0.0001			
At address < 2 yrs			0.0649*			
North East US	-0.007	-0.020		-*		
North Central US		-0.062*		-*		
South US	-0.0021	-0.026		-*		
MidWest US	-0.033					
Rural US	-0.027			ns		
Urban US				ns		
Area dummy		-0.049*				
Area income				ns		
Statewide branches	0.014					
No multibank HC	-0.033*					
County Unempl rate	0.0005*					
Herfindahl	-0.019*			-*		
2nd Exemp Quartile	0.028					
3rd Exemp Quartile	0.026					
Unltd bank exemp	0.055*					

Occupn dummies				ns		S & ns
Risk averse					ns	
Cheque acct					ns	
Saves		-0.030*				
Expects pension					ns	
Attitudes					ns	
% HH constrained in sample	17.3	18.9	18.6	17.3		15.6
Sample size	3706	2971	3285	3691		8017

- = significant at ≤ 5% (Magri, Fabri and Padula, Crook)
- = significant at ≤ 5% in 3 out of 4 years (Ferri and Simon)

Figure 1
Intertemporal Utility Maximisation

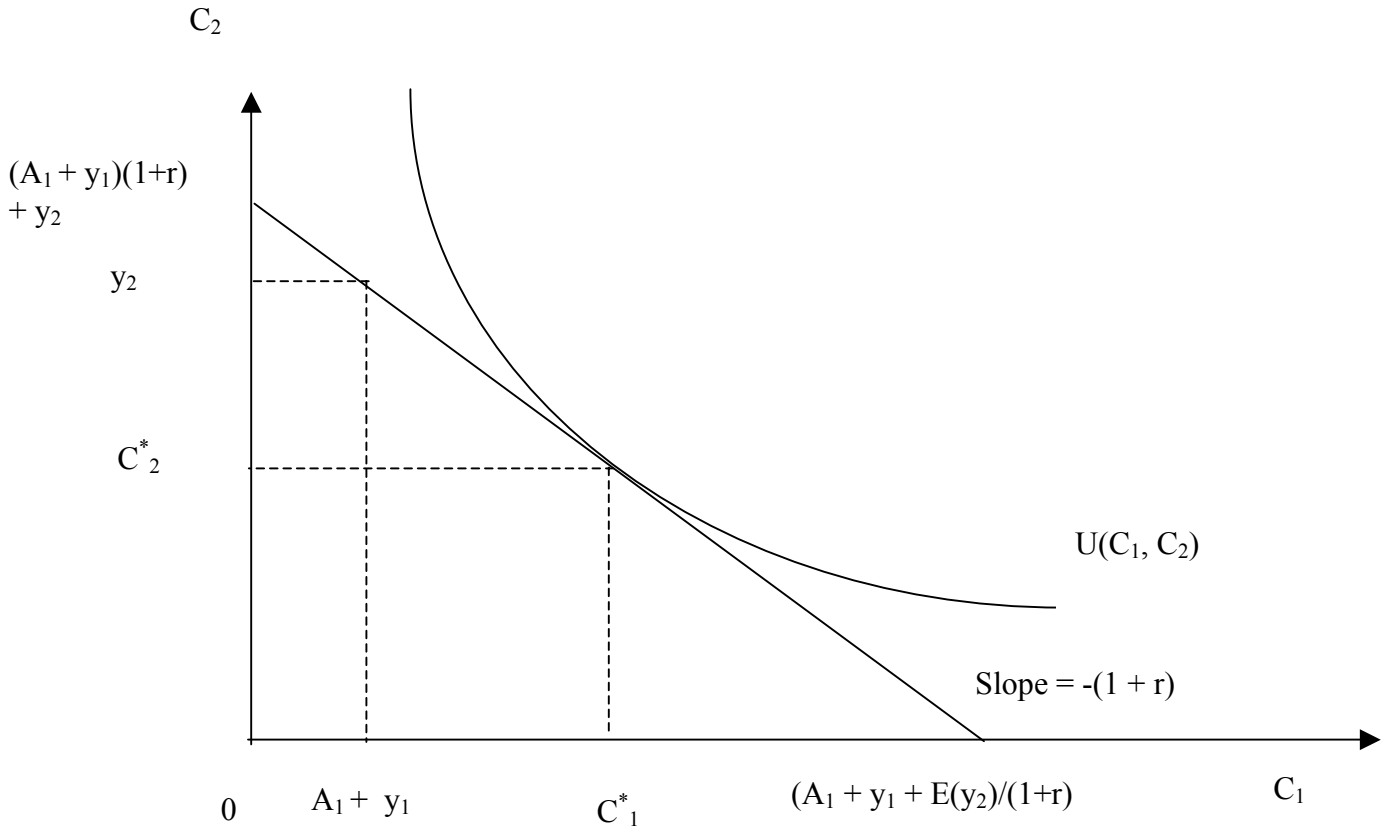


Figure 2

Observed data in Demand for equations

	Household is not constrained	**Household is constrained**
Household prefers positive debt	S_{11}	S_{10}
Household prefers no debt	S_{01}	S_{00}

S_{ij} = number of cases in row i, column j.

Figure 3

Strong Definition of Liquidity Constraints

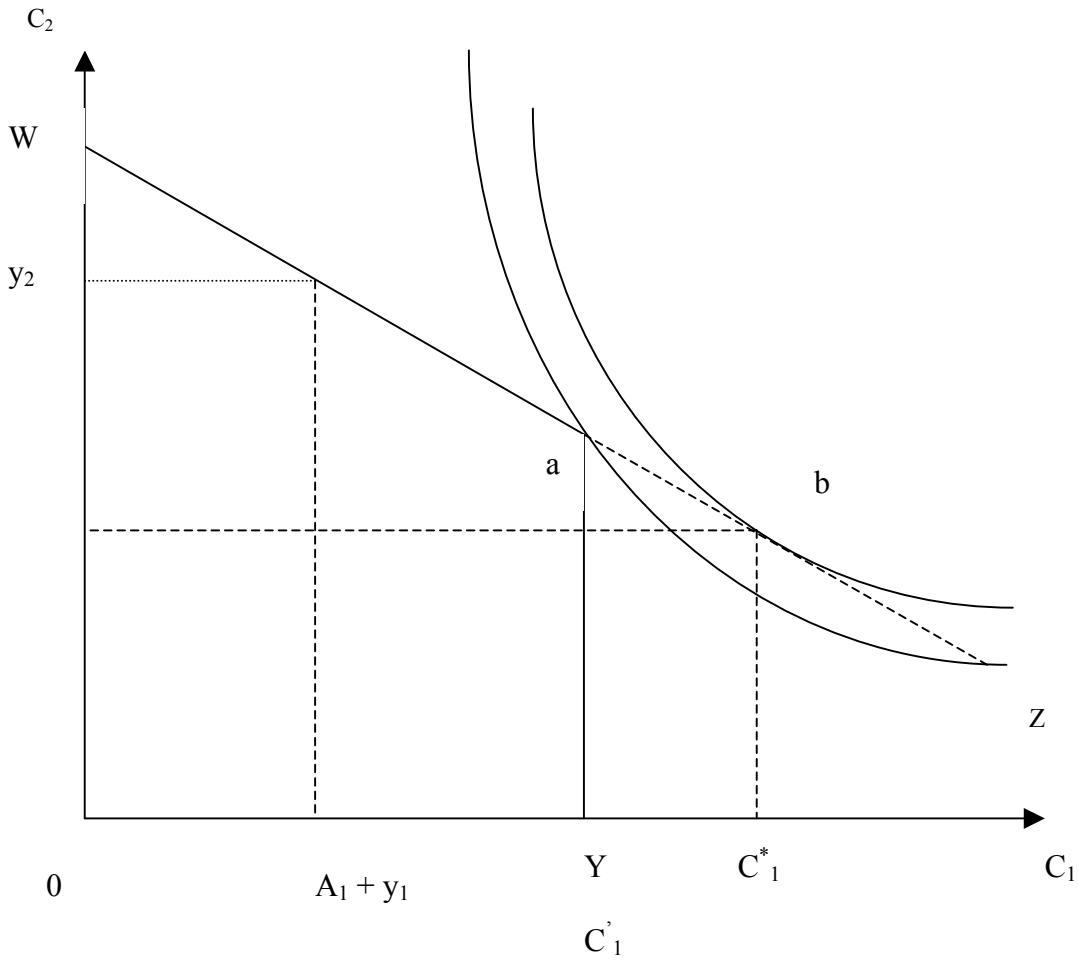
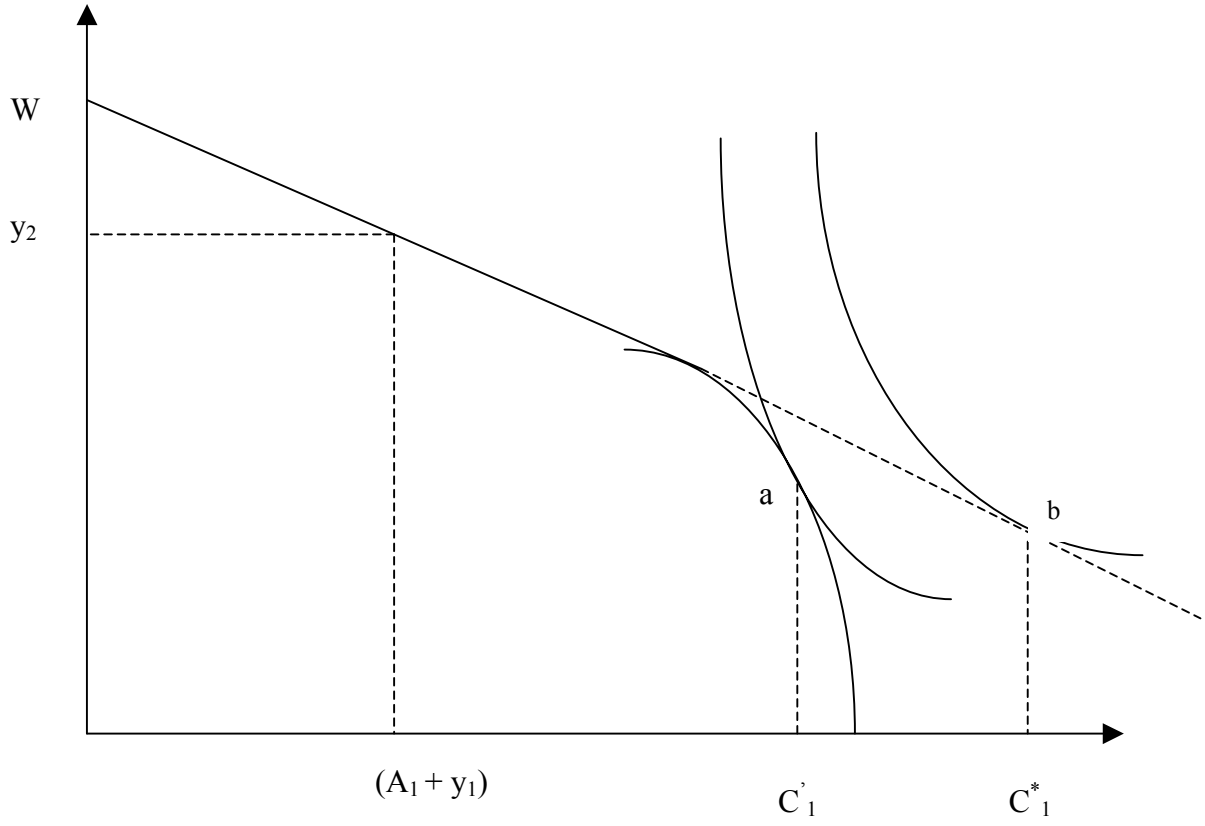


Figure 4
Weak Definition of Liquidity Constraints



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