Constraints and durable consumption

A new empirical approach

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draft 29.4.2010

Abstract

We use a novel two-step approach to study the effects of constraints on durable consumption. In the first step, credit constraints are quantified by stochastic frontier analysis. The effect of the constraints on durable consumption is then estimated in an 'errors in variables' regression. The method yields evidence of a significant effect of credit constraints on durable consumption. A fall of one unit in the constraints causes a fall of about one fifth in durable consumption in the short run. A permanent fall in the constraint leads to a permanent decline in the growth of durable consumption.

Keywords: durable consumption, credit constraints, stochastic frontier analysis, errors in variables regression

JEL: D12, D91, E21

1 Introduction

Even after decades of agency cost theory, the macroeconomic role of credit constraints is still poorly understood. Significant progress has been made in theoretical construction and numerical simulation of models with constrained behaviour (Carroll 2001). On the econometric front, indirect econometric evidence of constrained behaviour has been uncovered (Attanasio et al 2007, Gross and Souleles 2002, Attanasio and Jappelli 2001, Zeldes 1989 among others). Until late, however, no satisfactory econometric method has existed for estimation of the constraints and quantifying their behavioural effect.

We propose a two-step approach for estimating credit constraints and their impact on consumer behaviour. The method proposed by Herrala (2009) is used to estimate the credit constraints by stochastic frontier analysis of household level data. The estimated constraints and their variance are then used as proxies of credit constraints and their measurement error in an 'errors in variables' regression of durable consumption.

The method is applied to a household survey in Finland in 1988. The analysis yields evidence that durable consumption was significantly affected by credit constraints. A fall of one unit in the constraints causes a fall of about one fifth in durable consumption in the short run. A permanent fall in the constraint leads to a permanent decline in the growth of durable consumption.

The paper is organized as follows. The next section formalises the methodology. The econometric estimation of the constraints and their behavioural effect follows. The properties of the estimated models are then demonstrated with simulations. A short summary and our views on future work conclude.

2 Methodology

Consider a simplified stochastic, log linear credit constraint :

(2.1)

, where t denotes time, W wealth, β collateral policy parameter, and v a standard normal rv. The constraint determines the maximum amount a household can borrow. Behaviour is characterized by:

(2.2)

, where α denotes parameters, and ε a standard normal rv. Tangible wealth C is the source of durable consumption for households. Wealth is the sum of tangible and financial wealth (F):

(2.3)

The focus of interest the effect of credit constraints on durable consumption cannot be estimated directly from (2.2) since credit constraints are not observed.

However, credit constraints (2.1) can be estimated from borrower data as suggested by Herrala (2009). Formally, decompose observed borrowing L into two components, the constraint and the 'used part of the constraint' u: . Use (2.1) to get:

$$L_t = \beta * W_t + v_t - u_t \qquad (2.4)$$

Under specific assumptions about the distribution of u, (2.4) can be estimated by stochastic frontier analysis to quantify the credit policy parameters and the idiosyncratic variance of the constraints (.

These parameter estimates can then be used in an 'errors in variables' regression of (2.2).The fitted value serves as a proxy of the constraint and as an estimate of measurement error variance. Extension of the model to include additional explanatory variables in (2.1) and (2.2) is trivial

3 Estimation results

The method is applied to a complex survey of 5248 households by Statistics Finland from years 1987-8.[1] The estimation period was part of a boom phase in the Finnish economy after the deregulation of credit markets in 1986. The survey covers, among other variables, household income (Y), wealth (W) and debt (L). The stock of tangible wealth (C) reported in the survey includes real estate (own house, secondary house, and other real estate), vehicles (cars, caravans, boats, motorcycles, and snowmobiles) and telecom. Table 1 shows the variable means.

{Please insert Table 1 around here}

Two variants of the stochastic frontier model (2.4) of the credit constraints are discussed, reflecting alternative assumptions about the distribution of u (Table 2). In model π1, the distribution of u is half normal, and in model π2 exponential. In both models, credit constraints vary with wealth and income. Fixed and variable

[1] The surveys for saving and indebtedness.

effects across age and educational groups are allowed, as well as nonlinearity of the variables and cross effects between income and wealth.

The stochastic frontier models have been estimated in the sample of 1747 households that increased borrowing during the estimation year 1988. This guarantees that the parameter estimates of the credit constraints reflect credit conditions at that time. Since the entry decision to the credit market may be correlated with the residuals of the stochastic frontier model, sampling bias might arise. However, the Heckman method and the method of Greene (2008) for sampling correction failed to improve the estimated models. In the reported models $\pi 1$ and 2 sampling correction has not been used.

It is observed in table 2 that the parameter estimates in models $\pi 1$ and 2 are reasonably similar. The signs and magnitudes of the estimated parameters accord broadly with expectations. In both models, credit constraints increase significantly with income and wealth. Age has a negative fixed effect and education a positive fixed effect on household credit constraints.

{Please insert table 2 around here}

We then move to study the effects of credit constraints on consumer behaviour. In table 3, four variants of the dynamic behavioural equation, reflecting alternative assumptions about the constraint, the set of explanatory variables, and the estimation method, are presented. Models (i)-(iii) have been estimated with 'errors in variables' regression and, for comparison, model (iv) with OLS. In (i), (ii) and (iv), the constraint estimate is from model $\pi 1$, in in (iii) from model $\pi 2$. Model (ii) allows a more extensive set of fixed and variable effects than the other models.

In all estimations, credit constraints show a highly significant positive effect on durable consumption. In the 'errors in variables' models, the effect is between 15 % in model i and 24 % in model iii. The OLS estimate (9%) is much lower: it shows significant 'attenuation', a downward bias in the parameter of a badly measured variable.

{Please insert table 3 around here}

To verify the results, a large number of model variants have been estimated, with a broader set of indicator variables, disaggregated wealth, and alternative distributional assumptions on u. Perhaps the most significant issue revealed by the auxiliary regressions was that in some of the models the effect of income on the credit constraint was significantly smaller than in the models reported above. Apart from this issue, we find that, in the main, the results reported above are robust to changes in the model specifics.

4 Simulations

The estimated models and equation (2.3) can be used jointly to study, how changes in income, financial wealth, or the credit policy parameters affect durable consumption and credit constraints. In these simulations, model has been used to characterize credit constraints and model (ii) to characterize behaviour.

A benchmark and three alternative scenarios were considered. In the benchmark, income (Y), financial wealth (F) and the credit policy parameters β stay constant. In the three alternative scenarios income, financial wealth and the constant term in model ( ) fall permanently by 1 %. The simulation period was 10 years.

{Please insert Figure 1 about here}

It is observed in Figure 1 that in all three scenarios, durable consumption and credit constraints are below the baseline throughout the simulation period. Also, in all cases, the difference between baseline and the alternative scenarios is increasing. This implies that permanent changes in income, financial wealth and credit policy lead to a permanent change in the growth rate of durable consumption and credit constraints (rather than a level shift).

It is observed in Figure 1 that a 1 % fall in income is followed by approximately a 0.5 % fall in credit constraints in the short run. The short run effect equals , the parameter of income in model . The effect of the change in income on durable consumption is small in the short run, but it increases in time. At the 10 year mark durable consumption has fallen 1 % below benchmark, ie. as much as income.

It is also observed that a 1 % fall in financial wealth is followed by about a 0.3 % fall in credit constraints. At the 10 year mark, the level of durable consumption has fallen by 0.8 % from the benchmark in this scenario. A 1 % fall in the parameter leads to a 0.2 % 'across the board' fall in credit constraints in the short run. The short run effect on durable consumption is, again, small. The long run effect at 10 years is about 0.5 %.

5 Concluding remarks

We use a novel approach to estimate the effect of credit constraints on durable consumption. The method yields estimates of the magnitude and form of the constraints, and their quantitative impact on consumer behaviour.

More research is obviously needed in order to verify the results. In general, more studies are needed to shed light on the effects of constraint on consumption expenditure. We look forward to further studies of more comprehensive data sets, other countries and time periods.

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Figures and Tables

Table 1 Variable means

	1987	1988
C	3.74	3.85
L	2.10	2.22
W	3.35	3.56
Y	2.77	2.82

Note: Calculated with the svy: mean command in Stata. Variables: C=stock of tangible wealth; L=stock of loans; W=wealth stock; Y=disposable income. All variables in 1000 €, in natural logarithms. Data sources: Statistics Finland.

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Table 2 Stochastic frontier models of credit constraints

	π1	π2
β parameters		
constant	0.3***	0.2***
A1	-0.6	-0.7*
A2	-0.8**	-0.6*
EU	0.9**	1**
W88	0.2***	0.2**
Y88	0.5***	0.5***
A1*W88	0.1	0
A1*Y88	0.1	0.1
A2*W88	0	0
A2*Y88	0	0
EU*W88	-0.3***	-0.3***
EU*Y88	0.2	0.1
W88^2	0.02***	0.02***
Y88^22	-0.02	-0.04*
W*Y	0	0
variance of v	0.2	0.4
variance of u	3.2	1.1
auxilary information		
N	1747	1747
Iterations completed	26	24
log-likelihood	-2672	-2635
AIC	3.08	3.04
distribution of u	half normal	exponential

Note: Estimated by LIMDEP with probability weights. The endogenous variable is the loan stock in 1988. Exogenous variables: W88=wealth in 1988, Y88=income in 1988; A1=age 31-45 years, A2=age over 45 years; EU= university level; W^2 and Y^2 refer to the squared variables, and WY to their cross term. All variables in 1000 €, in natural logarithms. Data sources: Statistics Finland.

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Table 3 Dynamic models of durable consumption

Note: 'eivreg' refers to weighted 'errors in variables' regression and OLS to weighted least squares regression in Stata. The endogenous variable is the stock of tangible wealth in 1988 (C88). C87 is the stock of tangible wealth in 1987; ' ' and ' ' refer to the estimated frontiers in models π1 and π2 respectively (see table 2); EU= university level; A1=31-44 years old; A2= above 44 years old. The data sample includes all households with a non- zero level of the variables. Data source: Statistics Finland.

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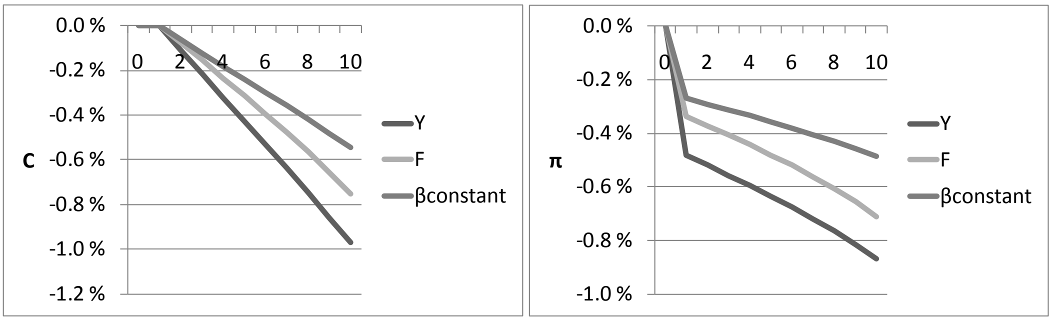
Figure 1 Tangible wealth (C) and credit constraints (π) when income (Y), financial wealth (F) or a credit policy parameter ( ) fall by 1 %.



Note: Simulated with models .and (ii). Sample averages calculated by the svy: mean command in Stata. C=the stock of tangible wealth; =the credit constraint; Y=income; F=financial wealth; .= the constant term in model . Variables in 1000 €, in natural logarithms. Periods=years. Data source: Statistics Finland.

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