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Abstract

This paper aims at analysing the impact of household borrowing on consumption. These variables are modelled jointly in a Vector Error Correction Model (VECM) where labour income, wealth variables and nominal interest rates are also included. The main estimation result is that deviations of borrowing from its long-run trend have a significant impact on consumption: when lending is above (below) its long-run level, future consumption contracts (expands). This evidence is also, found in a simpler model in which consumption is not modelled explicitly. In addition, when consumption departs from its long-run level, it seems to be an indicator of changes in future labour income.

JEL Classification: E20, E21, E51
Key words: Household debt, consumption, error correction

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1 Introduction

In the traditional consumption literature the role of debt has been relatively limited, since household borrowing is simply considered as an instrument to use future income and is usually supposed to adjust passively to consumer decisions. However, the empirical evidence has frequently found an excess sensitivity of consumption to current income that may point to the presence of liquidity constraints and hence to a role by lending in determining consumption. Liquidity constraints restrict consumption by current resources and, as Deaton (1991) stresses, they induce behaviour similar to that associated with a precautionary motive for saving[1]: people will accumulate assets in case they need a loan they cannot obtain. Moreover, regardless of whether households are credit-constrained or not, the credit channel theory also provides a framework to explain how imperfections in the credit market lead credit supply conditions to affect consumption. Shocks to the external finance premium (EFP)[2] will affect both the price that borrowers face when asking for external funds and, therefore, borrowers' consumption decisions.

Debt provides resources for financing household expenditure and permits consumption smoothing. However, a high level of household debt, recently observed in some industrialised countries, might also entail risks. A higher level of debt generally implies a higher debt-service burden and restricts the ability of households to gain access to additional external funds. Thus, a high level of debt raises households' vulnerability, reducing their ability to adjust when facing an unexpected shock to their income, their assets or interest rates. Thus unexpected shocks might constrain household spending decisions. Moreover, as Carroll and Dunn (1997) argue, a rapid increase in debt might also raise consumer sensitivity to labour income uncertainty. It is also important to stress that household external funds are granted by financial intermediaries, mainly banks, and, therefore, the strength of the household financial position also affects the stability of the financial system.

There is not, however, much evidence of what potential impact a relatively large level of indebtedness can have on consumption, although the experience of some coun-

[1] According to the precautionary demand for savings, people accumulate assets that act as a buffer stock, protecting consumption against negative shocks to income.

[2] The EFP reflects the cost of external finance due to credit market imperfections (costly monitoring, contract enforcement, informational asymmetries ...) and is usually proxied by the wedge between borrowing and lending interest rates. According to the bank lending channel, a contraction of monetary policy drains deposits from the banking system, reducing the supply of loans and raising the EFP. According to the balance sheet channel, the EFP depends inversely on the borrowers' creditworthiness.

tries is illustrative. For instance, during the 1980s the loosening of liquidity constraints in the United States led to a build-up of debt that seems to have contributed to the weakness of consumption during and after the 1990 recession. More recently, borrowing might have also played a role in macroeconomic developments in the Netherlands, or Portugal. Consumption growth during the last expansionary phase was supported by a strong growth of borrowing in these two countries, especially in the Netherlands through the extensive use of mortgage equity withdrawal[3]. However, the high level that debt has reached might also have played a role in the protracted economic slowdown of these two economies since 2001. Thus, household borrowing could have important macroeconomic implications by delaying and limiting the scope of expansionary phases or deepening recessions.

These potential macroeconomic consequences of borrowing have recently attracted much attention in the case of Spanish households. The indebtedness of Spanish households has more than doubled in recent years. While in 1995 the overall amount owed was around 46 per cent of annual income, by the end of 2003 it stood at over 92 per cent. This level is slightly above the average in the euro area but below the indebtedness of, for instance, British and US families (see Table 1).

The rise in household debt in Spain in recent years is usually regarded as a process of a structural nature. The liberalisation of the Spanish financial system, the improvement in income expectations, the dynamism of the labour market and, particularly, the greater macroeconomic stability and lower financing costs derived from participation in the European Monetary Union largely explain the increasing indebtedness of this sector (see, for example, del Río (2002) for more details). However, the current level of leverage has probably increased the exposure of the sector to shocks to variables that affect its ability to repay debt.

This paper aims at illustrating the impact that an excessive level of indebtedness can have on household consumption, using Spanish aggregate data. In particular, we estimate a Vector Error Correction Model (VECM), where consumption and borrowing are modelled jointly, and test whether consumption reacts when household borrowing departs from its long-run determinants. Previous empirical evidence of borrowing determinants in Spain has usually focused on a single-equation approach where this type of

[3]According to De Nederlandsche Bank estimations, the impact of mortgage equity withdrawal on economic growth was 1% in both 1999 and 2000, and it made a negative contribution of 0.5% in 2001 (see, for example, De Nederlandsche Bank (2002)).

evidence cannot be tested (see, for instance, Manrique and Sáez (1998), del Río (2002) or Nieto (2003)). Our approach is to some extent in line with that of Chrystal and Mizen (2001) who model simultaneously consumption, unsecured debt and money for British households. But, as will be seen later, we obtain rather different conclusions.

The paper is organised as follows. Section 2 reviews some empirical evidence regarding the relationship between credit and consumption. Section 3 describes the econometric methodology. Section 4 shows the main estimation results. In Section 5 an alternative especification is estimated as a robustness exercise. Finally, Section 6 concludes.

2 Review of the empirical literature

As it has been explained in the introduction, credit market developments can be important in explaining household consumption. In particular, greater credit availability can lead to an increase in external resources and hence in consumption, since expenditure decisions are not always taken under the assumptions of the permanent income theory. At the same time, excessive indebtedness can lead to a higher debt-service burden with a possible negative impact on consumption. However, there is not much empirical evidence on the relevance of credit related variables in explaining consumption, an especially difficult task with aggregate data.

Some papers study the effect of credit market conditions on consumption including a proxy variable of the external finance premium variable (EFP) in a consumption function. For example, de Bondt (1999) analysed the impact of the wedge between the mortgage and savings deposit interest rate on total private consumption, and found evidence of a significant effect in Germany, Italy and the Netherlands, but not in France, the United Kingdom or Belgium. In the same line, King (1986) found that the wedge between borrowing and lending interest rates was statistically significant in British consumption.

Other empirical evidence has focused on credit aggregates. For example, Antzoulatos (1996) found that the debt-income ratio can improve aggregate consumption forecasts for the United States. In particular, he found an underprediction of consumption growth after periods of rising consumer debt to income ratio. In a similar vein, Bacchetta and Gerlach (1997) reported a significant impact of credit aggregates on consumption in the United States, Canada, United Kingdom, Japan and France. Specifically, the expected growth of income and mortgage and consumer credit was correlated with consumption of non-durable goods and services in these countries. They also found that the excess sensitivity of consumption to income is small, and often insignificant, when credit is included. Nevertheless, in their framework it is difficult to discern whether the positive correlation between consumption and aggregate credit stems from borrowing of unconstrained households in advance of expected income increases, rather than from shifts in credit availability. Another study that relates the excess sensitivity of consumption to income with lending availability is that of Japelli and Pagano (1989). Using data from Greece, Japan, Italy, Spain, Sweden, the United Kingdom and the United States, they showed that the excess of sensitivity is higher in countries with lower borrowing, where capital market imperfections might be more important. If this is the case, credit constraints might affect consumption through changes in the credit availability. Also Ludvingson (1996) analysed the implications for the excess sensitivity of changes in the fraction of income that can be borrowed by households. Differently from other studies, she considered a random (instead of fixed) variation in the credit ceilings, a key feature in order to explain her finding: consumption growth is correlated not just with predictable income growth but also with predictable consumer credit growth in the United States.

Brayton and Reifschneider (2003) followed a quite different approach. They analysed the informational content of financial indicators for unexplained movements in real activity for the United States as measured by the residuals of consumption and investment equations. They found that these indicators contain little or no additional information for predicting the consumption of nondurables, while some of them turned out to be statistically significant for household investment decisions (durable consumption and residential investment).

Finally, Chrystal and Mizen (2001) used money and unsecured borrowing to explain the consumption of British households. They estimate a conditional VECM for consumer expenditure, money balances, and unsecured lending with exogenous explanatory variables such as labour income, total net wealth, interest rate spreads, consumer confidence and unemployment. They assumed three long-run equilibrium relationships where consumption is determined by the level of credit and money. The results showed that in the long run consumption is negatively related to unsecured debt and in the short run deviations of consumption from its long-run equilibrium affect lending positively.

3 Econometric methodology

As mentioned in the introduction, we jointly model consumption and borrowing using a VECM approach. The estimation is carried out in two steps, as explained, for example, in Doornik and Hendry (1997)[4]. In the first step the long-term cointegrating relationships are estimated. Secondly, a reduced form model, that uses as identities these long-run relationships, is estimated.

Let suppose the following p order unconditional Vector AutoRegression (uVAR):

$$X_t = \sum_{j=1}^{k} A_j X_{t-j} + \mu + \varepsilon_t \qquad \varepsilon_t \sim N_p(0, \Lambda), \tag{1}$$

where X_t is a p-dimensional vector of $I(1)$ seasonally adjusted variables with t ranging from 1 to T, μ is a vector of constants, and ε_t is a p-dimensional random vector of serially uncorrelated errors with variance-covariance matrix Λ.

If there are r cointegration relationships, the VAR model can alternatively be written as a VECM

$$\triangle X_t = \Pi X_{t-1} + \sum_{j=1}^{k-1} \Gamma_j \triangle X_{t-j} + \mu + \varepsilon_t \qquad \varepsilon_t \sim N_p(0, \Lambda) \tag{2}$$

with $\Pi = \alpha\beta = A_1 + A_2 - I$ if $0 < rank(\Pi) < p$. Where $\triangle$ is the first-difference operator, I is an identity matrix, $\Gamma_j (= -A_{-j-1})$ are the short-run dynamic matrices and α and β are $(p \times r)$ and $(r \times p)$ (full rank) matrices of loading factors and long-run coefficients, respectively, with r being the cointegration rank. The vector of constants is left unrestricted to allow for deterministic time trends in the levels of the data.

The number of cointegration relationships (r) is determined by the Johansen maximum likelihood-based method (see, for example, Johansen (1995)). The null hypothesis ($H(r)$) is that the cointegration rank is at most r[5]. And two alternative maximum LR test statistics can be used. In the $\lambda - max$ test statistic, $\tau_{\lambda-max} = -Tln(1 - \hat{\lambda}_h)$, the

[4] All computations in this paper are performed using PcGive 9.1.

[5] That is to say, there are r eigenvalues of the square matrix Π that are non-zero. If Π is full rank ($r = p$) then X_t variables are stationary and if the rank is zero ($r = 0$), then ΔX_t is stationary or all linear combinations of X_t are $I(1)$.

alternative hypothesis is at most $r+1$ cointegrating relations. The alternative hypothesis in the trace test statistic, $\tau_{trace} = -T \sum_{h=r+1}^{p} ln(1-\hat{\lambda}_h)$, is full rank ($p$ cointegrating relations).

Once the number of cointegrating relationships is determined, identification restrictions are needed to ensure uniqueness of vectors α and β. These restrictions should be derived from economic theory. Identification is achieved when the number of restrictions (q) is larger than or equal to r^2. Thus, in the context of a single cointegration relationship the standardisation condition is enough.

If some variables can be considered as exogenous, the dimension of the system can be reduced. It is important to note that exogeneity is a relative concept that must be defined in relation to parameters of interest (see, for example, Ericsson et al. (1998)). Invalid exogeneity assumptions lead to inefficient or inconsistent estimates.

If the vector X_t is partitioned into g endogenous variables (y_t) and $k-g$ conditioning variables (z_t): $X_t = (y_t, z_t)$, model (2) is equivalent to the conditional model for y_t, (3), and the marginal model for z_t, (4):

$$\triangle y_t = \Lambda_{12}\Lambda_{22}^{-1} \triangle z_t + \sum_{j=1}^{k-1}\Gamma_j^* \triangle X_{t-j} + \alpha^*\beta X_{t-1} + \mu + \varepsilon_{1t} \qquad \varepsilon_{1t} \sim N_p(0,\Sigma^*) \quad (3)$$

where $\Gamma_j^* = \Gamma_{j1} - \Lambda_{12}\Lambda_{22}^{-1}\Gamma_{j2}$, $\alpha^* = \alpha_1 - \Lambda_{12}\Lambda_{22}^{-1}\alpha_2$ and $\Sigma^* = \Sigma_{11} - \Sigma_{12}\Sigma_{22}^{-1}\Sigma_{21}$

$$\triangle z_t = \sum_{j=1}^{g-1}\Gamma_{j2} \triangle X_{t-j} + \alpha_2\beta X_{t-1} + \mu + \Psi D_t + \varepsilon_{2t} \qquad \varepsilon_{2t} \sim N_p(0,\Sigma_{22}) \quad (4)$$

If variables in z_t are weakly exogenous for the long-run parameters β, then the dimension of the system can be reduced to the conditional model with no loss of information for the estimation of β. The necessary and sufficient condition for weak exogeneity of z_t is that the loading factors of the long-run relationship (α_2) are zero in the marginal model 4 (see Johansen (1992), Urbain (1992) or Boswijk (1995)). For example, in the context of a single-cointegration relationship the VECM could be reduced to a single-equation ECM for estimating the long-run coefficients only if weak exogeneity is previously tested.

The model is then estimated including long-run relationships as identities. First difference of variables are regressed on their lags and the cointegrating relationships.

This system of equations is a reduced form model. Using additional identifying restrictions an structural model (SECM) could also be estimated, but this is out of the scope of this paper.

4 Model specification and estimation results

In order to jointly model consumption and credit, we consider the following variables: real household borrowing[6] (l), real household consumption[7] (c), real household housing wealth[8] (hw), real net financial wealth (fw)[9], real labour income (y) and nominal interest rates[10] (i). The private consumption deflator is used to transform variables into real terms. The data are quarterly and cover the period 1984 Q1 to 2003 Q4. All variables are seasonally adjusted (using the TSW (Tramo-Seats) program) and expressed in log form (except interest rates). Figures 1 and 2 show the level, growth and first differences of these variables.

Household debt is assumed to be determined by consumption, which proxies permanent income, by housing wealth, which reflects the role of home value as collateral for mortgage credit, and by the cost of financing[11]. As previously formulated in Martínez-Pagés and Maza (2003) and Nieto (2003), the latter is proxied by nominal interest rates. The main reason for using nominal instead of real interest rates is that, as illustrated

[6] We consider bank loans, including securitisation. Nominal values are from quarterly series of the Spanish financial accounts which go back to 1989 Q4. This variable is extended backwards to 1984 Q1 using as supplementary information the growth of bank loans to the private sector.

[7] We use aggregate private consumption. Source: INE.

[8] This time series is available from 1987 Q1. Previous values are estimated. The original time series is adjusted for four outliers, using TSW (Tramo-Seats): three additive outliers in 1988 Q4, 1990 Q4 and 1991 Q4, respectively, and a transitory change starting in 1990 Q1.

[9] This time series is available from 1994 Q4. For previous quarters, it has been extended backwards .

[10] Nominal interest rates are a weighted average of housing and consumption interest rates using outstanding housing and consumer bank loans as weights.

[11] Note, however, that observed household borrowing is also the result of other factors that it is difficult to include in this empirical analysis. Supply factors are key determinants of credit market developments. They may depend on the attitude towards risk of financial entities which may vary over the business cycle or with the degree of competition in the market. In this respect the structural change in the Spanish financial system as a result of its progressive development and liberalisation and the increase in competition might have played a not insignificant role. In addition, when aggregate data are used, demographic shifts could also be important if there are changes in the proportion of population groups with a different propensity to borrow.

in the Annex, credit supply conditions are tipically related to nominal rather than real interest rates. In this regard, a reduction in nominal interest rates with constant real rates will normally increase the supply of credit and, therefore, could have an impact on consumption. This aspect is very important for the Spanish experience, where the disinflationary process has allowed households to increase their indebtedness capacity both through a reduction in the intitial debt burden and the lengthening of repayment terms. It is also important to note that this disinflationary process experienced by the Spanish economy during the sample period introduces serious difficulties for estimating real interest rates[12].

In the case of consumption we adopt a simple specification where total consumption[13] is determined, in the long run, by current labour income, housing wealth, real net financial wealth and household borrowing. Current labour income reflects human capital, while non-human wealth is proxied by the stock of residential property and real net financial wealth. As housing and financial wealth can be endogenously determined, they are included in a lagged form.

In order to determine the order of integration two different unit root tests are used: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests (see Table 2). In the ADF test the lag length is selected such that the residuals of the ADF regression do not show a significant autocorrelation. The null hypothesis of a unit root for the variables in levels cannot generally be rejected. For the first differences the null hypoth-

[12] In any case, we have also estimated alternative specifications, that use different definitions of real -instead of nominal- interest rates and the empirical results where not acceptable. Cointegration tests showed an excessive number of cointegration relationships, and if two cointegrating relationships were imposed, in spite of these test results, the coefficients that are found for some variables were difficult to interpret, probably due to this difficulty in estimating real interest rates empirically. Moreover, as will be seen in Section 5, the main findings of this paper do not depend on the long-run specificiation that has been used to model the consumption.

[13] Permanent Income Hypothesis applies to non-durable consumption and services plus the flow of services from the stock of durable goods. However, it is difficult to approximate this aggregate and many empirical studies use total private consumption. Some authors assert that non-durable consumption is theoretically more appropriate if the share of durable goods in total consumption has been relatively stable in real terms. It is also sometimes argued that the estimation of non-durable consumption requires the relative price of non-durables with respect to durables as an additional variable, while the total consumer expenditure deflator is employed (see, for example, Fernández-Corugedo et al. (2003)). The evidence for Spain suggests that the relative prices of durable and non-durable consumption are not statistically significant in consumption functions (see Estrada and Buisán (1999)). We do not include this variable so as to keep the estimation problem more tractable.

esis is easily rejected in the case of consumption, nominal interest rates, net financial wealth and labour income. For household borrowing and housing wealth a higher order of integration cannot be ruled out. However, as it is conceptually difficult to interpret non-stationarity of quarterly growth rates, all variables are treated as integrated of order one.

Given that assumption, equation (2) is estimated in order to determine the number of cointegrating relationships. In particular we estimate a four-order uVAR (specified in levels) with the constant unrestricted. According to the *trace* test statistic with small sample correction[14] we can assume two cointegrating relationships (see Table 3). Also, the cointegration tests corresponding to a conditional model in which housing and financial wealth have been considered as weakly exogenous[15] (see lower panel of the table), point to the existence of two cointegrating relationships[16]. As can be seen, the estimated model is congruent with the data in the sense that we do not find serial correlation and non-normality in the residuals[17].

The identification of the different cointegrating relations is made imposing restrictions on the β matrix. We impose the normalisation restrictions for consumption and borrowing and zero coefficients for interest rates in the consumption equation[18] and for labour income and financial wealth in the borrowing equation, in accordance with the reasoning given above. As shown in Table 4, interest rates do not participate in the adjustment to the long-run equilibria. Hence we can proceed estimating a conditional system with a lower number of parameters, in which this variable is also considered weakly exogenous, together with housing and financial wealth. Final estimation is presented in Table 5, where non-significant loading factors (α) have also been restricted to zero. Exogeneity tests are presented in Table 6, and show that this hypothesis can be accepted at conventional significance levels.

As can be seen, the coefficients have the expected signs in both the consumption and borrowing equations. In the former, consumption is positively related to income and

[14] Critical values are provided in Osterwald-Lenum (1992).

[15] The inclusion of these two variables as weakly exogenous is based on the fact that they are included in lagged form in the specification. This assumption will be tested later.

[16] This system includes four lags for housing wealth and three lags for net financial wealth.

[17] These have been the criteria for selecting the lag length in the VAR model. Alternative selection criteria (BIC or AIC) could also be employed. The lag length selection is important, since it can affect the dimension of the cointegrating space: overfitting implies a loss of power, while underfitting leads to potential spurious cointegration (see for example Boswijk and Franses (1992)).

[18] Any effect of interest rates on consumption is then captured through its impact on borrowing.

also to lending, with a coefficient of 0.55 and 0.11, respectively, and also to both types of wealth. In the borrowing equation, borrowing is positively related to consumption[19] and housing wealth, and negatively related to nominal interest rates. Table 7 shows the result of substituting and expressing the consumption and borrowing as a function of income, housing wealth, net financial wealth and interest rates. As can be seen, the relative importance of current income in the consumption equations seems to be higher than in the credit equation, and the opposite is found for housing wealth and interest rates. Likewise, in the latter equation, the role of housing wealh is larger than that of financial wealth, something that reflects the fact that financial assets cannot generally be used by individuals as collateral for borrowing. In the consumption equation, the response of this variable to both types of wealth is not statistically different[20].

The value of the estimated loading factors (α) in Table 5 determine the dynamics of adjustment towards the long-run equilibrium. In particular, when borrowing departs from its long-term trend, the adjustment towards equilibrium implies not only a change in borrowing, but also a change in consumption. More specifically, when lending is above (below) its long-run level, restoring equilibria is achieved via reductions (increases) in lending but is also accompanied by a contraction (expansion) in the level of consumption with a relatively large elasticity (0.09). These movements imply a slow speed of correction (8% per term), so that disequilibrium can result in a lengthy contractive effect on consumption. In the case of consumption, positive (negative) deviations of consumption from its long-run level are corrected not only via reductions (increases) in this variable but also through increases (reductions) in future labour income. Therefore, when consumption departs from its long-run level, it seems to be an indicator of changes in future income. The latter result is consistent with the evidence shown in Sastre and Fernández (2004).

Figure 3 displays the estimated long-run relationships and error correction terms re-scaled to average zero over the sample period. As can be seen, there was a large increase in borrowing in the second half of the eighties and the nineties. It is related, in the first case, with supply-side factors derived from regulatory changes in the banking sector. As regards the nineties, this important increase reflects a convergence of credit

[19] We find a low t-ratio (1.40) for this variable, given the large standard deviation associated with the estimation of this coefficient. This seems to be related to a multicollinearity problem: if the housing wealth coefficient is restricted to 0.4, then the t-ratio that is obtained for consumption increases to 5.58, as explained in Table 4.

[20] The p-value for the overidentifying restrictions when this restriction is added is 18%.

towards a higher equilibrium level. In the the first few years of the present decade, borrowing seems to be above its long-run determinants, although much less so than, for instance, at the beginning of the nineties.

Table 8 shows the full estimation of the VECM when including the estimated long-run relationship and assuming that interest rates, financial and housing wealth are also exogenous for the estimation of short-term parameters (the lower panel of Table 6 shows that exogeneity assumptions for short-run dynamics can be accepted, according to the corresponding tests). Residuals graphs presented in Figure 4 suggest that real loans to households and consumption are reasonably well explained. In spite of the small sample, one-step ahead residuals and Chow tests are presented in Figures 5 and 6, and it may be that at some point these tests may suggest a potential non-constancy of parameters which is difficult to assess given the length of the sample.

As mentioned in the introduction, our approach is reasonably in line with that of Chrystal and Mizen (2001), although it is not strictly comparable. We focus on total consumption and credit (instead of unsecured credit) and we do not include demand for money. Our results are also different from theirs. First, they estimate a negative long-run effect of the level of consumer borrowing on consumption, capturing the effect of the debt-service burden on disposable income. This negative sign is the conventional one, implicit in their net wealth variable, and would imply that the consumer credit rate spread (over the base interest rate) has a positive effect on consumption. In addition, their endogenous variable, i.e unsecured lending, excludes mortgage equity withdrawal, which has been an important source of financing consumption in the United Kingdom. Secondly, Chrystal and Mizen (2001) do not find that an excess of credit leads to adjustments in consumption. However, they find that when consumption is above its long-run trend, borrowing increases to sustain spending above its long-run determinants.

5 Robustness of the results: a simpler model

A critical point in the model estimated in the previous section could be the particular specification of the consumption equation. To test the sensitivity of our results to changes in the specification of the consumption model, in this section we present a simpler model to contrast to what extent disequilibrium in the borrowing level has a significant impact on consumption levels with no explicit model for consumption in the long run. Thus, we drop labour income from our analysis, and model borrowing as a function of consumption, housing wealth and interest rates[21], and proceed in a similar way as we did in the previous section.

As can be seen in Table 9, we find one cointegration relationship among the variables considered. We then estimate a restricted VECM with one cointegration relationship and restrict to zero those coefficients that are statistically insignificant. The results, shown in the table[22], indicate that in this alternative approach, where the long-run behaviour of consumption is not modelled explicitly, we still find that the disequilibrium in the credit market has a significant effect on consumption. Likewise, the estimated coefficients in the cointegrating relation for borrowing are very similar to those obtained in the model with two cointegrating relationships shown in the previous section, and also the loading factors for borrowing and consumption. Therefore, the results presented in section 4 do not seem to depend on the empirical approach used to model consumption.

This simpler model is to some extent comparable to that of Calza et al. (2003). They focus on the private sector as a whole and also estimate a VECM, assuming one cointegration relationship between loans, interest rates and gross domestic product in the euro area. In contrast to our results, they find that imbalances in the level of lending with respect to its long-run level are partially corrected via interest rate changes, while the scale variable, gross domestic product, is found to be weakly exogenous.

6 Conclusions

The indebtedness of Spanish households has risen sharply in recent years. The increase in Spanish household debt during the last few years is, at least partially, a process of a structural nature. The liberalisation of the Spanish financial system, the improvement in income expectations, the dynamism of the labour market and, particularly, the greater macroeconomic stability and lower financing costs derived from participation in the European Monetary Union largely explain the increasing indebtedness of this sector.

[21] In this specification, we do not include financial wealth, since, as mentioned in the previous section, we consider that the impact of this variable on borrowing is captured through consumption, which proxies permanent income.

[22] The complete analysis of this VECM is not shown for reasons of space. The results are available from the authors upon request.

This sharp rise has merited much attention because of its important macroeconomic and financial implications. In particular, the increase in debt has helped to sustain the growth of consumption and residential investment and, probably, the resilience of the Spanish economy to the global economic slowdown in recent years. However, there are some risks if the level of indebtedness proves to be excessive, since it could delay and limit the scope of expansionary phases or deepen recessions. This paper provides some evidence on this. We model consumption and borrowing jointly in a VECM where labour income, housing and financial wealth, and nominal interest rates are also included. The results show that both consumption and lending are positively related to both types of wealth and labour income in the long run, and negatively related to interest rates. The impact of interest rates on consumption are mainly captured indirectly through borrowing in the consumption long-run relationship. More importantly, our results evidence that when lending is above (below) its long-run level, restoring the equilibrium is achieved via reductions (increases) in lending and accompanied by a contraction (expansion) in the level of consumption. Moreover, the slowness of the disequilibrium correction implies that the negative impact of excessive indebtedness on consumption can be lengthy. This result holds even if we consider a simpler model with a single cointegration relationship between borrowing, consumption, housing wealth and interest rates. Similarly, our results support the empirical evidence found in Sastre and Fernández (2004): when consumption departs from its long-run level, it seems to be an indicator of changes in future labour income.

According to our model, the sharp increase in Spanish household borrowing is compatible to a large extent with changes in its long-run fundamentals, but in the last few years this rise may have led to a borrowing level higher than that determined by these long-run fundamentals, which could negatively affect the levels of consumption.

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Figure 1. Household borrowing and some explanatory factors: 1984.I - 2003.IV

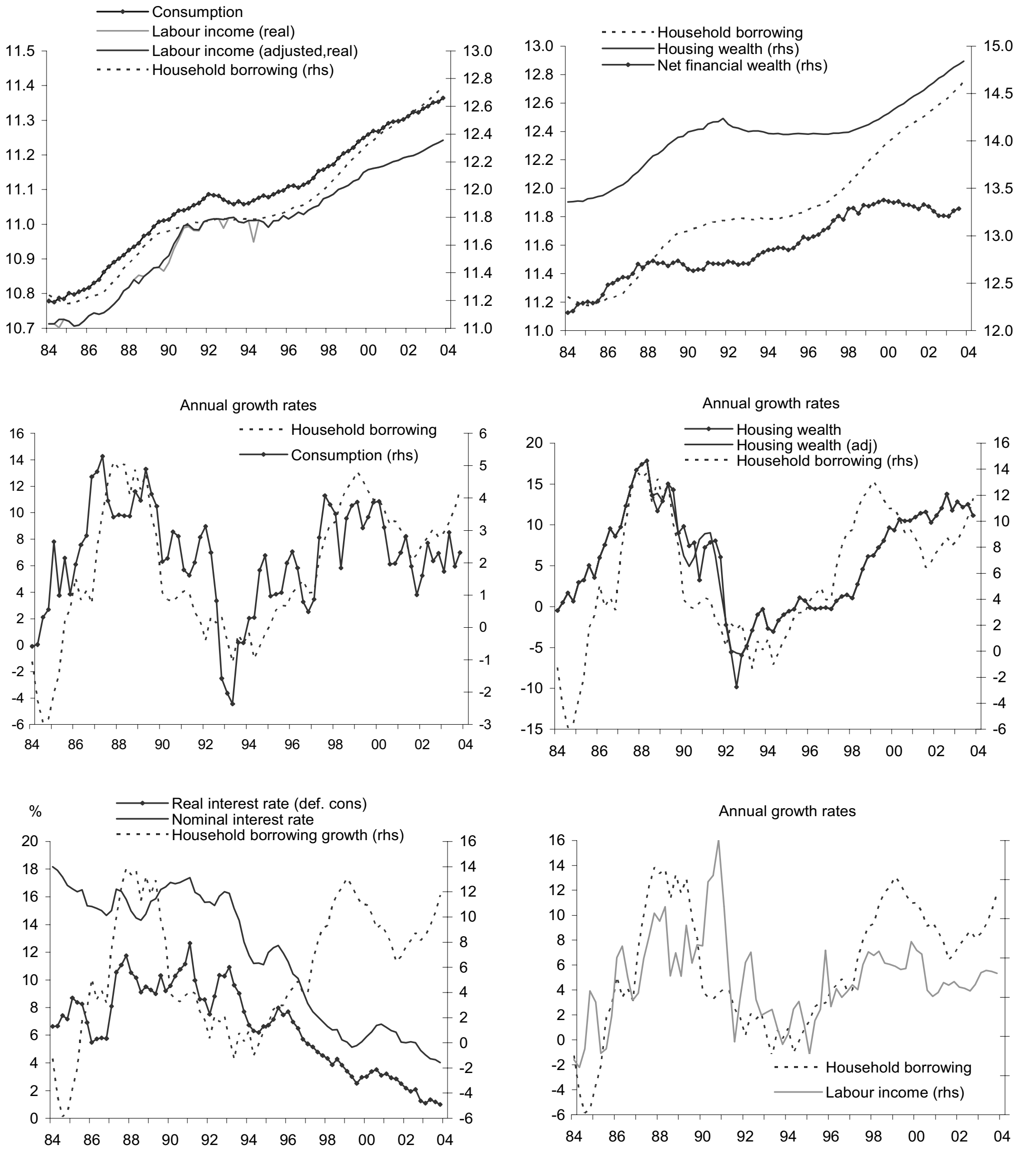


Figure 2. First differences of explanatory variables

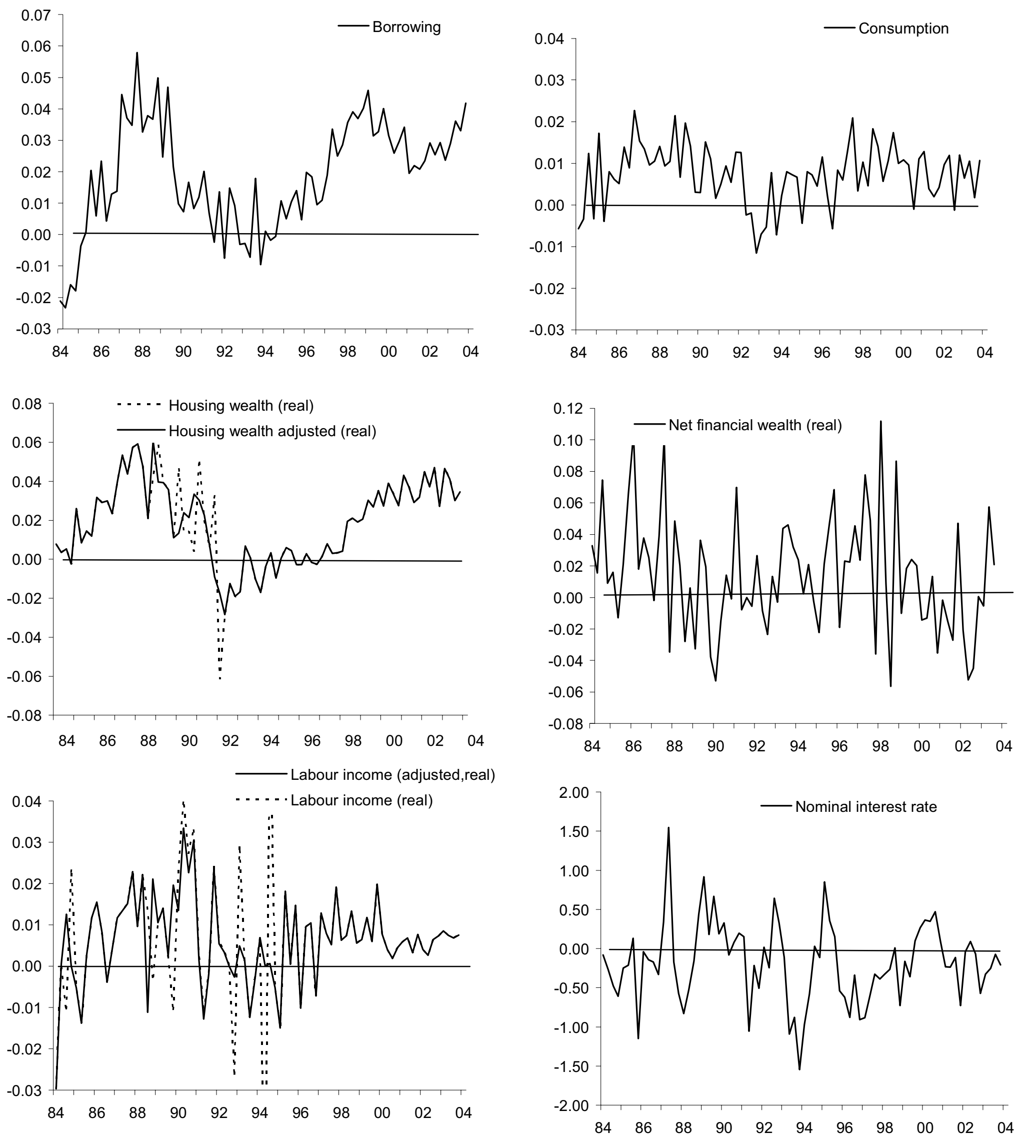


Figure 3. Estimated long-run relationships and error correction terms

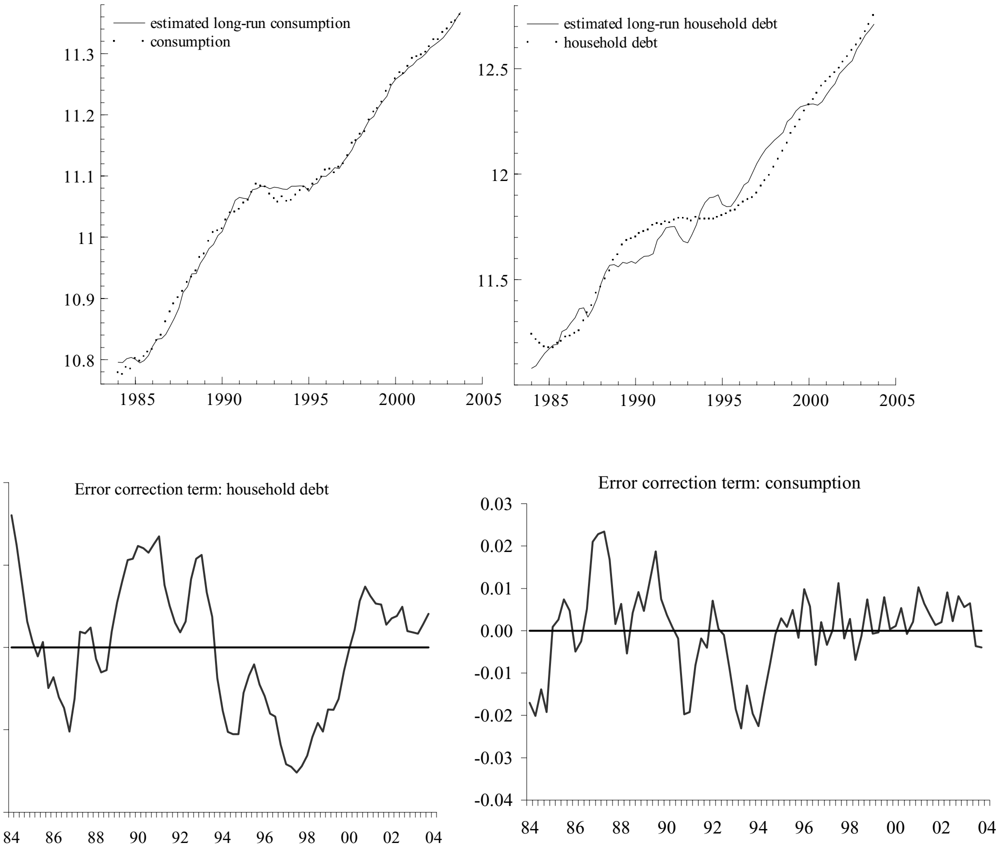


Figure 4. fitted variables and residuals

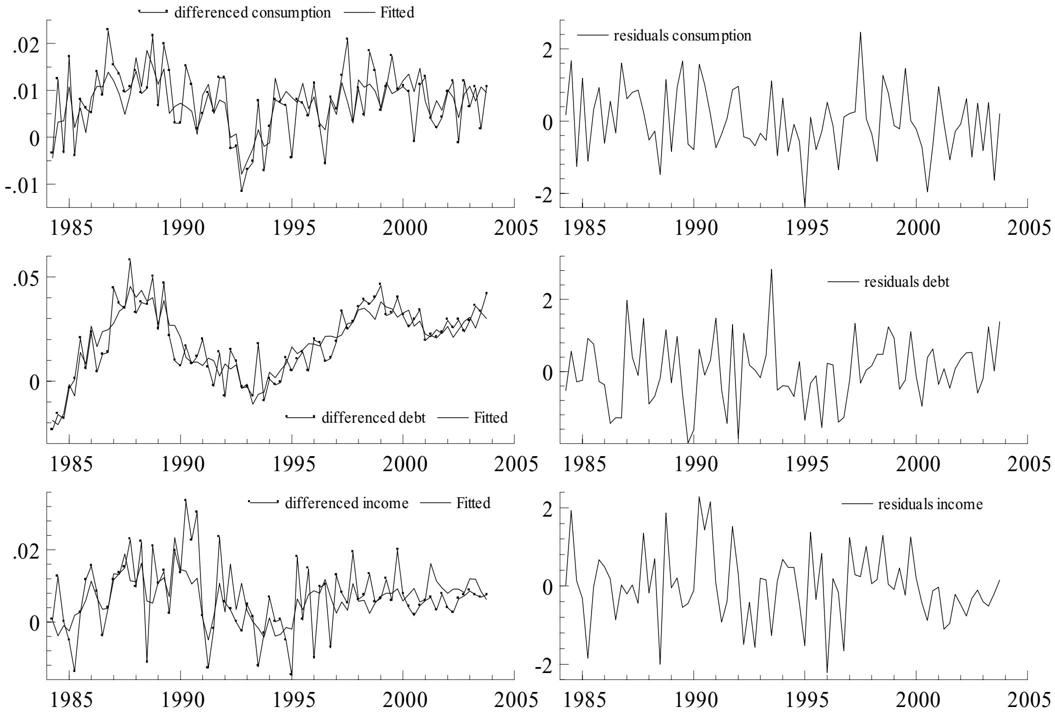


Figure 5. One-step ahead residuals

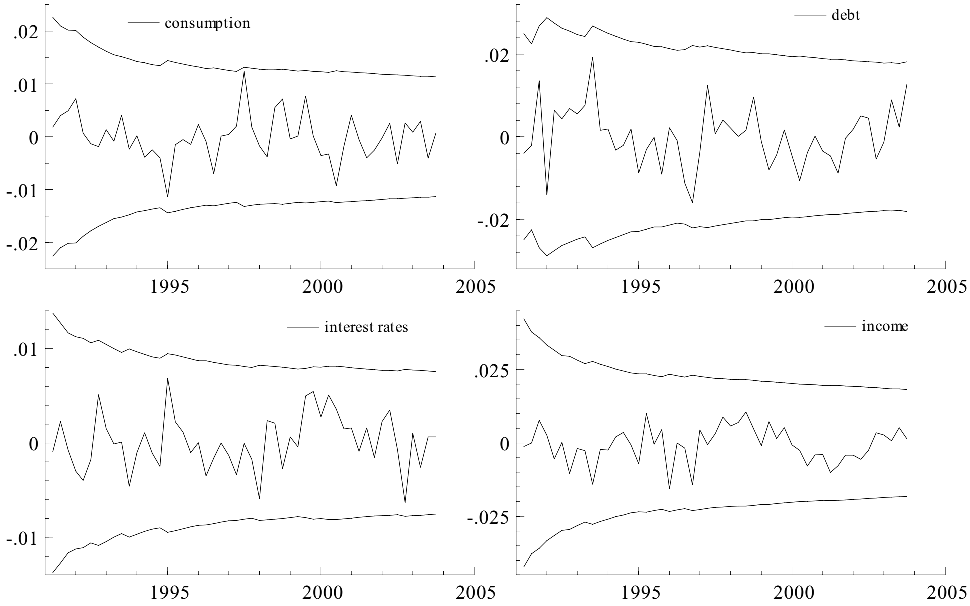


Figure 6. One-step Chow test

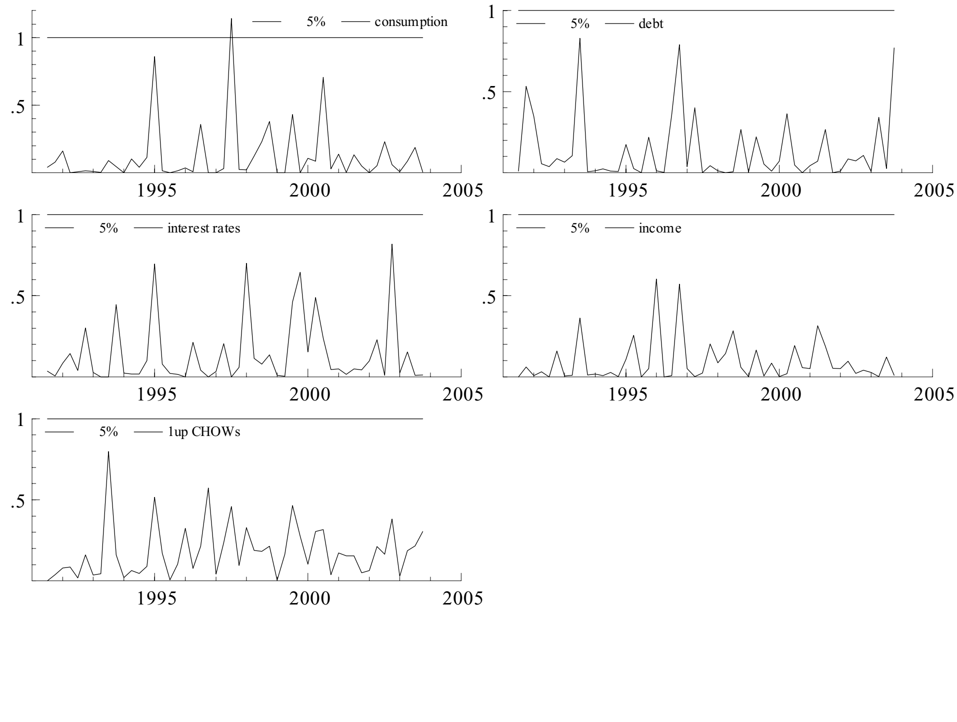


Table 1. Household indebtedness in Spain

		1990	1995	2000	2003
Total liabilities	(%gdi)	62.7	61.5	85.9	102.2
Total loans (a)	(%gdi)	45.8	46.1	72.2	92.3
Long-term loans	(%gdi)	41.5	41.6	67.2	87.2
Debt-burden	(%gdi)	…	10.6	12.9	13.0
Bank loans by purpose (% bank loans) (b)					
Housing			61.9 (c)	63.9	67.7
Consumption			17.3 (c)	17.6	13.7
Other			20.8 (c)	18.5	18.6
Securitisations	(% total loans)	0.0	0.7	3.0	6.7
Variable interest rates	(% loans (d))		34.9	49.5	61.7
International comparison (debt-income ratios)					
Euro Area (e)		…	68.4	80.8	84.6
US		82.7	89.2	96.9	110.1
UK		105.0	94.6	104.0	126.3

(a) Including securitisations.

(b) Excluding securitisations.

(c) Corresponds to 1997.

(d) As percentage of bank loans to *Other Resident Sectors* (include households and non-financial corporations).

(e) Estimation, only nine countries.

Source: Banco de España, Federal Reserve Board, ONS

Table 2. Unit root tests

	Level				First difference				Order of integration
	t	lags	ADF	PP	t	lags	ADF	PP	
Real consumption	c	3	-0.15	0.59		2	-1.78*	-4.35***	1
Household borrowing	c	3	0.99	1.97		3	-1.1	-1.80*	1/2
Nominal interest rate	c	3	0.00	0.04		3	-4.69***	-5.25***	1
Labour income		2	3.56	3.82		3	-3.58*	-9.38***	1
Housing wealth		3	1.66	3.91		2	-1.14	-2.37**	
	c	3	-0.83	0.87	c	2	-1.96	-3.46**	1/2
Net financial wealth	c	3	-1.76	-0.94		2	-3.50***	-7.94***	1

Note: The null hypothesis is the presence of a unit root and ***, **, * denotes rejection of the null hypothesis at 1%, 5% and 10% significance level respectively based on critical values by MacKinnon (1991). ADF denotes Augmented Dickey Fuller test (with lags up to and including the highest lag statistically significant at least at the 5% level), PP is for the Phillips Perron test. If a constant is included it is denoted with 'c'.

Table 3. Johansen tests for cointegration

Unrestricted model

Ho: rank=r	l-max test statistic	small sample correction	95% critical values	trace test statistic	small sample correction	95% critical values
r = 0	48.23**	33.76	39.4	151.8**	106.3**	94.2
r ≤ 1	38.03*	26.62	33.5	103.6**	72.52*	68.5
r ≤ 2	33.52**	23.47	27.1	65.57**	45.9	47.2
r ≤ 3	20.09	14.07	21	32.05*	22.44	29.7
r ≤ 4	11.49	8.04	14.1	11.96	8.369	15.4
r ≤ 5	0.4699	0.329	3.8	0.4699	0.329	3.8

Diagnostic tests

	LM test		Normality test		Arch Test		Heterocedasticity	
Single equation tests								
c_t	0.371	[0.8664]	0.721	[0.6974]	0.982	[0.4264]	0.076	[1.0000]
l_t	0.805	[0.5516]	3.231	[0.1988]	0.181	[0.9469]	0.114	[1.0000]
i_t	1.962	[0.1006]	4.082	[0.1299]	0.431	[0.7856]	0.130	[1.0000]
y_t	1.284	[0.2858]	1.822	[0.4021]	0.491	[0.7421]	0.214	[0.9992]
fw_t	3.832	[0.0051]	0.542	[0.7628]	0.752	[0.5614]	0.180	[0.9998]
hw_t	1.261	[0.2953]	1.792	[0.4083]	0.892	[0.4760]	0.196	[0.9996]
System	1.128	[0.2368]	9.547	[0.6557]			1020.300	[0.3866]

Restricted model

Variables entered restricted: financial and housing wealth

Ho: rank=r	l-max test statistic	small sample correction	95% critical values	trace test statistic	small sample correction	95% critical values
r = 0	46.38**	37.11**	27.1	97.91**	78.33**	47.2
r ≤ 1	35.69**	28.55**	21	51.53**	41.22**	29.7
r ≤ 2	**13.19**	**10.55**	**14.1**	**15.83***	**12.67**	**15.4**
r ≤ 3	2.642	2.114	3.8	2.642	2.114	3.8

Diagnostic tests

	LM test		Normality test		Arch Test		Heterocedasticity	
Single equation tests								
c_t	0.466	[0.7993]	0.489	[0.7831]	0.863	[0.4932]	0.276	[0.9994]
l_t	0.812	[0.5468]	2.695	[0.2598]	0.049	[0.9953]	0.377	[0.9931]
i_t	2.286	[0.0604]	4.561	[0.1022]	0.368	[0.8301]	0.506	[0.9578]
y_t	1.941	[0.1045]	3.843	[0.1464]	0.512	[0.7275]	0.587	[0.9117]
System	0.974	[0.5450]	9.574	[0.2962]			0.309	[1.0000]

Note: The VAR model includes four lags of endogenous variables specified in levels. The constant term is unrestricted. * (**) denotes existence of cointegration at 5% (1%) significance level. In the diagnostic tests, p-values are in brackets. The LM test is the Godfrey test for autocorrelation. For normalitiy the Doornik and Hansen test is used. Arch test is for autoregressive conditional heteroscedasticity test. The heterocedasticity test is a White test for individual equations and the Doornik and Hendry test for the whole system. See Doornik and Hendry (1998) for more details.

Table 4. Restricted cointegrating vectors

Long-run coefficient (*)

	c_t		l_t	y_t	fw_{t-1}	hw_{t-1}	i_t
β_1	**1**		**-0.11**	**-0.54**	**-0.05**	**-0.04**	0
std errors			0.02	0.07	0.01	0.01	
β_2	-0.63	(*)	**1**	0	0	**-0.42**	**4.65**
std errors	0.48					0.15	0.74

Loading factors

	Disequilibrium in			
	Vector 1 consumption		Vector 2 borrowing	
	α	std errors	α	std errors
Δc_t	**-0.33**	0.13	**-0.08**	0.02
Δl_t	0.29	0.20	**-0.12**	0.03
Δi_t	-0.13	0.09	-0.01	0.01
Δy_t	**0.80**	0.21	0.02	0.03

(*) Net financial wealth is restricted to zero in the borrowing equation. The p-value for this restriction is 0.74. If housing wealth coefficient is restricted to 0.4 in the long-run equation for borrowing the parameter for consumption does not vary significantly (0.69) and the t-statistic raises to 5.58.

Table 5. Over-identified conditional system

Long-run coefficients

	c_t	l_t	y_t	fw_{t-1}	hw_{t-1}	i_t
β_1	**1**	**-0.11**	**-0.55**	**-0.05**	**-0.04**	**0**
std errors		0.02	0.08	0.02	0.02	
β_2	**-0.66**	**1**	0	0	**-0.42**	**4.49**
std errors	0.47				0.15	0.73

Loading factors

	Disequilibrium in			
	Vector 1 consumption		**Vector 2 borrowing**	
	α	std errors	α	std errors
Δc_t	**-0.40**	0.13	**-0.09**	0.02
Δl_t	_	_	**-0.14**	0.03
Δy_t	**0.71**	0.20	_	_

Overidentifying restrictions test

LR-test, rank=2: Chi^2(3) = 2.68 [0.44]

Table 6. Exogeneity tests

Weak exogeneity for long-run parameters

Variables in marginal model: hw, nfw, i

Regressor Distribution:

ECM_c_{t-1}	F(3,57)	= 0.38381 [0.7651]
ECM_l_{t-1}	F(3,57)	= 0.52930 [0.6640]
ECM_c_{t-1}, E	F(6,114)	= 0.39955 [0.8780]

Weak exogeneity for short-run parameters

ξ_{hw}	F(3, 54) =	1.1399 [0.3413]
ξ_{fw}	F(3, 54) =	0.085091 [0.9679]
ξ_i	F(3, 54) =	0.22031 [0.8819]

Table 7. Over-identified cointegrating vectors as function of interest rates, labour income and wealth variables

Long-run coefficients

	c_t	l_t	y_t	fw_{t-1}	hw_{t-1}	i_t
β_1	1		-0.60	-0.05	-0.09	0.54
β_2		1	-0.39	-0.04	-0.48	4.84

Table 8. Second step VECM

	Δc_t		Δl_t		Δy_t	
	coeff	*t-value*	*coeff*	*t-value*	*coeff*	*t-value*
variable						
Δc_{t-1}	-0.04	-0.32	-0.46	-2.38	-0.12	-0.65
Δl_{t-1}	0.02	0.36	0.24	2.40	-0.16	-1.60
Δl_{t-2}	-0.14	-2.19	0.16	1.53	0.21	2.03
Δy_{t-1}	0.03	0.45	0.09	0.80	0.18	1.61
Δy_{t-2}	0.00	-0.06	0.18	1.65	0.01	0.07
ECM_c_{t-1}	-0.43	-3.80	0.20	1.14	0.55	3.14
ECM_l_{t-1}	-0.09	-5.72	-0.10	-4.41	0.02	0.76
Δi_{t-1}	0.33	2.12	-0.13	-0.55	-0.04	-0.16
Δi_{t-2}	0.28	1.55	0.51	1.82	-0.41	-1.46
Δi_{t-3}	0.35	2.11	0.04	0.14	0.25	0.97
Δhw_{t-1}	0.13	2.31	0.19	2.26	-0.05	-0.57
Δhw_{t-3}	0.24	3.78	0.15	1.49	0.02	0.18
constant	1.01	3.65	-0.58	-1.34	-1.36	-3.15
Std. Dev. Residuals		0.0055		0.0085		0.0085
Sum sq.residuals		0.0020		0.0048		0.0047

Diagnostic tests

Equation	Autocorrelation		Normality test		Arch 4		Heterocedasticity	
consumption	0.632	[0.6757]	0.226	[0.8930]	1.559	[0.1975]	0.601	[0.9070]
borrowing	0.846	[0.5224]	1.429	[0.4894]	0.139	[0.9671]	0.641	[0.8760]
income	0.729	[0.6042]	1.826	[0.4013]	0.194	[0.9408]	0.790	[0.7273]
System	0.850	[0.7319]	3.710	[0.7159]			0.706	[0.9878]

Table 9. VECM with one cointegration relationship for household debt

Johansen test for cointegration

Ho: rank=r	l-max test statistic	small sample correction	95% critical values	trace test statistic	small sample correction	95% critical values
r = 0	37.8**	30.24*	27.1	63.32**	50.66*	47.2
r ≤ 1	19.19	15.35	21	25.52	20.42	29.7
r ≤ 2	4.845	3.876	14.1	6.337	5.07	15.4
r ≤ 3	1.493	1.194	3.8	1.493	1.194	3.8

Long-run coefficients

Model 1	l_t	i_t	c_t	hw_{t-1}
β	1	4.28	-0.72	-0.41
std errors		0.75	0.50	0.16

Loading factors

	α	std errors
Δl_t	-0.12	0.02
Δi_t	0	
Δc_t	-0.07	0.02
Δhw_{t-1}	0	

Overidentifying restrictions test

LR-test, rank=2: Chi^2(2) = 0.72792 [0.6949]

Diagnostic tests

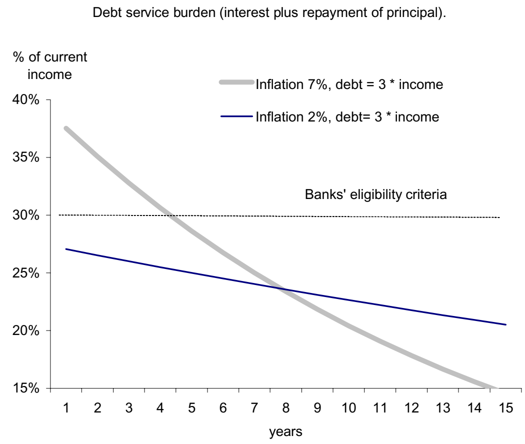
	LM test	Normality test	Arch Test	Heterocedasticity
Single equation tests				
c_t	0.88002 [0.5003]	2.1391 [0.3432]	0.06635 [0.9917]	0.52543 [0.9617]
l_t	1.5413 [0.1913]	4.0345 [0.1330]	0.44243 [0.7774]	0.77057 [0.7652]
i_t	0.36668 [0.8693]	1.5913 [0.4513]	2.1282 [0.0896]	0.35582 [0.9975]
w_{t-1}	1.4763 [0.2116]	5.2775 [0.0714]	0.38216 [0.8204]	0.38885 [0.9950]
System	1.1537 [0.2224]	11.59 [0.1704]		0.56343 [1.0000]

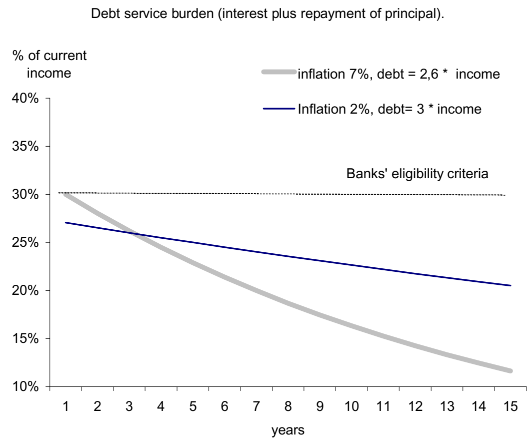
Annex: Nominal interest rates and supply-loan conditions

One of the key criteria banks apply for determining the supply of credit for an individual is the initial debt burden (interest payment plus repayment of principal) as a percentage of current income (rather than expected income). This criterion means, as illustrated below, that the supply of credit and, therefore, the resources available for consumption, depends, among other variables, on the level of the nominal, rather than real, interest rates.

To illustrate this, let us consider an individual who demands a loan of 3 times current income. Available credit instruments consist of 15-year loans where the reimbursement is made through constant nominal payments (including interest payments). For simplicity we assume that income increases with inflation (income is constant in real terms). We consider two different scenarios for (constant) inflation: high (7%) and low (2%). In both cases real interest rate is set to 2%. Therefore, nominal interest rates are, respectively, 9% and 4%. Let us also assume that banks are reluctant to satisfy demand for loans if the initial debt burden is above 30 per cent of current income. Figure A shows the debt-service burden for this particular case. As can be seen in the upper panel, in spite of the fact that real cost is the same in both secenarios, the distribution of real payments during the loan life is radically different. In particular, when nominal interest rate is equal to 9% the demand for loans cannot be fully satisfied if banks apply their eligibility criteria. In fact, in a context of high inflation, debt would be restricted to a level of 13.3% lower in order to satisfy the eligibility criteria (see low panel), thus reducing available resources for consumption. Against this background, a reduction of nominal interest rates, leaving real rates unchanged, can increase the level of debt that households can obtain and hence the resources available for consumption.

Figure A:


Debt service burden (interest plus repayment of principal).
% of current income
Inflation 7%, debt = 3 * income
Inflation 2%, debt= 3 * income
Banks' eligibility criteria
40%
35%
30%
25%
20%
15%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
years


Debt service burden (interest plus repayment of principal).
% of current income
inflation 7%, debt = 2,6 * income
Inflation 2%, debt= 3 * income
Banks' eligibility criteria
40%
35%
30%
25%
20%
15%
10%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
years

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