# Household debt sustainability: What explains household non-performing loans?

# An empirical analysis



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## Abstract

Sound household financial conditions are relevant for both financial and monetary stability. Therefore, we analyse household financial fragility in a sample of euro area countries with the aim to shed some light on the nature of the large debt increase accumulated in recent years. We focus on household arrears on payment obligations, which are one of the most direct measures of financial stress of the sector. The probability of falling into arrears is derived from a life-cycle type of model and is investigated empirically using a cross-section and time series approach. We analyse cointegration and model arrears within an error-correction framework. The results suggest that the financial conditions of households might become more vulnerable to adverse shocks in their income and wealth.

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# Non-technical summary

The sharp increase in the debt to income ratio in developed countries has raised concerns about a parallel rise in household financial fragility that would affect macroeconomic and financial stability. On the one hand, macroeconomic stability, financial developments and legal or institutional changes could have lead to an increase in the level of debt towards a new equilibrium by easing credit rationing. On the other hand, market imperfections may lead to mistakes in the bank credit policy in an expansionary phase. This, combined with the myopic behaviour of some lenders in a euphoric climate, may increase borrower's debt levels excessively and result in an increase in problematic loans. Therefore, the aim of this paper is to understand to which extent the current increase in the debt to income ratio of households constitutes a movement towards a new equilibrium or, rather, is related to a riskier financial position for the sector.

To highlight the issue we analyse an empirical model for the household's ratio of non-performing loans, which constitutes the best indicator available for household financial fragility. We derive the empirical specification from a life-cycle model which allows for the probability of default. The introduction of liquidity constraints into the life-cycle model allows to explain why changes in the structure of the lending market have a significant impact on the amount of household borrowing, and the fact that additional determinants can play a role in determining borrowing decisions (current income, nominal interest rate, disposable collateral, etc.). Most models incorporate borrowing restrictions imposing them exogenously rather than explaining them as an endogenous response to default risk. Our theoretical set-up draws from Lawrance (1995), who introduces explicitly a default option into a model of life-cycle consumption to explain how the possibility of default influences the level of consumption, its sensitivity to income, and the type of borrowing constraints likely to emerge. We use her basic set-up, but we extend the model to allow for the possibility to borrow, not only for consumption but also to invest in real or financial assets.

The expression for the determinants of NPL obtained from the model is then studied empirically using a panel of seven euro area countries (Belgium, France, Finland, Ireland, Italy, Portugal and Spain) and is estimated as an error-correction model. The dataset spans from 1989Q3 to 2004Q2, although the panel is unbalanced because for most countries such long series are not available.

We find that the set of variables included in the model tends to explain a good proportion of the variation of arrears, indicating that the model captures quite well the factors behind

arrears' developments. The model suggests that, in the long-run, an increase in the ratio of indebtedness to income is associated with higher levels of arrears. However, if the rise in the debt ratio is accompanied by a rise in real disposable income, the negative effect is more than offset. This suggests that increases in real disposable income would allow -other things being equal- relatively higher increases in the debt to income ratio combined with a same level of the ratio of arrears. Monetary conditions are also important because rising inflation and lending rates significantly worsen financial conditions. However, these effects might be difficult to perceive in the short-run given that the model needs around two years and a half for a complete transmission of possible shocks.

Moreover, in the short-run the role of financial wealth and housing wealth (proxied by the house price index) tends to confirm the idea that wealth is used as a buffer in case of unexpected shocks. Even though, on the one hand, housing wealth, being less liquid, plays a minor role in relieving financial stress as compared to financial assets, on the other hand, it still helps, in accordance with the view that collateral can be used to overcome asymmetric information problems.

In general, we can conclude that the recent rise in the debt ratio has put the household sector in a riskier financial position. In fact, the main attenuating impact on such risk is played by rises in income, but in the countries considered the evidence is that income has not grown enough to offset the effects of the increasing ratio of debt. At the same time, other possible short-term adjustments are absorbed only slowly.

Finally, differences between countries seem to be very important and globally exacerbate household financial conditions. These differences are likely to be related to institutional characteristics and structural supply-side factors, which play a key role in determining the stability of financial conditions and, therefore, the equilibrium level of household debt. However, besides the relevance of country specific factors, we believe that considering the household sector from a euro area perspective can provide useful pieces of information for the conduct of the common monetary policy.

# 1. Introduction

Over the past two decades in many countries household borrowing has grown considerably, both in absolute terms and relative to household income, reaching record levels. Such a sharp rise has received much attention because of its important macroeconomic and financial implications.

The origin of such increase is related to the deregulation of financial markets that occurred in many countries during the first part of the 1980s (Group of Ten (2003), Girouard and Blondal (2001)). The deregulation process boosted competition among financial institutions obliging them to improve their efficiency. At the same time, the intense development in information technologies has implied a big change in the financial industry. Over the course of the last decade technological progress has reduced dramatically the high transaction costs that traditionally characterised financial intermediation in general and, mortgage finance in particular. These costs were essentially related to the costs of information, the key input throughout the lending process; their reduction produced large economies of scale, further enhanced by industry consolidation (LaCour-Little, 2000). This evolution of the supply side of the market for credit has created the conditions for larger availability of credit to individuals (thanks also to the introduction and spreading of new financial products) and a reduction of borrowing constraints. These factors, together with the low interest rate regime, have contributed to the increase of household credit at historically high levels.

Therefore, macroeconomic stability, financial developments and legal or institutional changes could have lead to an increase in the level of debt towards a new equilibrium by easing credit rationing without having increased risk. As a consequence, it is crucial to determine the extent to which the increase in the ratio of debt to income also implies an increase in the financial fragility of the household sector. Ideally one should explore this question by focusing at the level of individual households and use the individual information to draw a complete picture of the sector. Unfortunately, in the euro area the scarcity of information on a disaggregated basis did not allow us to conduct such disaggregated analysis. Thus, we focused on household financial fragility and, hence the quality of household loans portfolio, by using aggregate data. In particular, in the paper we investigate household sector financial fragility related to high debt burden in a sample of euro area countries.

To measure financial fragility we concentrate on household debt reimbursement problems, interpreted as the most extreme outcome of excessive indebtedness. These problems are reflected in the ratio of debt arrears to total household debt. More specifically, arrears on debt are identified with non-performing loans. In the remainder of the paper, therefore, we will use arrears and non-performing loans (NPL) as synonyms. NPL are defined as loans that are in arrears for at least three months. Although the specific denomination for these loans varies across countries, the concept is very similar in all of them (for more details see appendix 3).

Changes in the level of arrears are clearly linked with financial problems: an increase in the level of arrears is a sign of an increased proportion of financially constrained households. Therefore, being one of the most direct measures of household ability to repay the debt, arrears can be a good proxy for household financial fragility. Thus, we analyse empirically the behaviour of household non-performing loans to see how they react to possible changes in macroeconomic conditions to shed some light on the nature of the recent debt increase and its implications.

The outline of the paper is as follows. First we discuss the relevance of household financial conditions for macroeconomic stability by explaining the links between debt, household distress and consumption in view of some stylised facts and on the basis of the theoretical literature. The third section derives a theoretical model for individuals' decisions about consumption and debt when there is a possibility to default. This model allows to highlight the potential determinants behind household arrears to use in the empirical specification. Then, in the fourth section, we discuss some data issues and the empirical specification of the model. In section five we present the main results obtained from the cointegration analysis of non-performing loans and, finally, a few tentative conclusions are offered.

## 2. Macroeconomic relevance of household debt

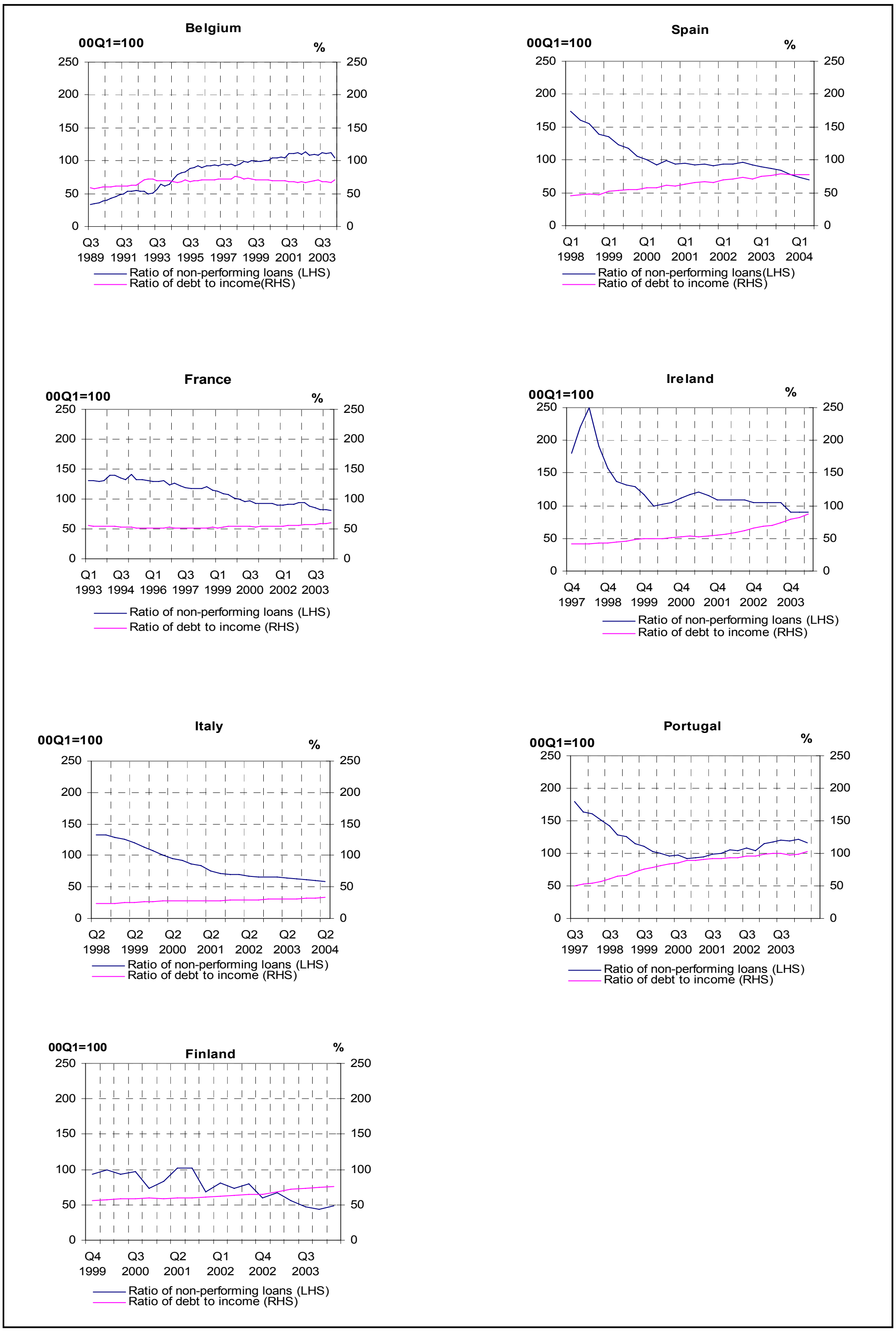
Since the beginning of the 1990s there has been a rapid build-up of household debt in the euro area, both in terms of ratio of debt to disposable income and, in terms of debt to GDP. The ratio of total household debt to disposable income rose by more than 50% since the early '90s, reaching a ratio of 86% at the end of 2004.

Notwithstanding that, the ratio of debt service burden to income, which is an important measure of the ability to face repayment commitments, has remained broadly unchanged during the last decade. The increase in principal repayments has been offset by the decrease in interest burden. Of course, although as a whole the ratio is the same, the increase in the level of debt involves higher sensitivity to changes in interest rates. Such higher sensitivity mainly depends on the proportion of contracts with floating rates because in these contracts the risk related to changes in interest rates is fully transferred to the borrowers.

Notwithstanding these general trends, the situation differs widely across the euro area countries. For instance, among the largest five euro area countries, the Netherlands has a ratio of household debt to GDP of 108% while in Italy the same ratio amounts to only 34%. At the same time the share of mortgage loans in the total also widely differs, ranging from the 50% of Italy to 88% in the Netherlands. These disparities give us an indication of the importance of country specific factors in explaining debt behaviour (e.g. different regulation in the mortgage market and in the housing market).

Unfortunately, the ratio of arrears at the euro area level is not available, but we have this ratio for seven countries that represent about 70% of euro area population, being Belgium, Finland, France, Ireland, Italy, Portugal and Spain. As shown in Figure 1, during the sample period for which we have comparable data (since 1998) a general downward trend for the ratio of NPL can be observed, coinciding with an increase in the debt to income ratio. The only exception is Belgium, where the ratio of debt has remained broadly unchanged while the ratio of NPL has slightly increased. Looking at the developments for the six other countries, since 1998 we can observe significant increases in the ratio of debt although with different intensity across countries. France has registered the lowest increase, around 18%, while Ireland and Portugal the highest, with a rise of more than 100%. Spain, with a climb of 68%, stood above the average, while Italy and Finland experienced rises of 50% and 35% respectively. However, the ratio of non-performing loans has showed a pronounced decrease in the same period. The drop in the ratio of non-performing loans has been more similar across countries with respect to the debt ratio, ranging from 31% in France to 60% in Spain and Ireland. In the middle, Italy, Finland and Portugal showed falls by 55%, 48% and 36%, respectively.

## Figure 1: The ratio of debt to income and non-performing loans



Therefore although increasing household debt ratios raise concerns about household financial fragility, so far this risk has not materialised. Thus, the aim of this paper is to understand to what extent the current situation can be explained by lags in the response of arrears to increasing debt ratios or rather by structural changes. In the first case we can expect as a consequence a dramatic increase in the ratio of arrears in the future, while in the second case we would not expect such negative effects. Gaining a better understanding on this issue is crucial also because both the stability of the financial system and monetary stability are closely related to household financial fragility. The stability of the financial system hinges to a large extent on household financial fragility because in most cases, despite the existence of collateral and lender's legal protection, personal bankruptcy is costly for lenders. On theoretical grounds, in an efficient world bank lending rates should reflect the true default risk for the underlying assets and bank profitability; therefore the bank lending policy should be driven by the risk appetite of the banks. This, however, does no longer hold when the risk attitude of the bank changes over the cycle, or when a bank faces distorted incentives in taking lending decisions. For instance, disaster myopia, herding behaviour, perverse incentives and principal-agent problems may lead to mistakes in the bank credit policy in an expansionary phase. This, combined with the myopic behaviour of some lenders in a euphoric climate, may increase borrower's debt levels excessively and result in an increase in problematic loans. A rise in loan defaults higher than expected can then lead to a tightening in credit availability and, in turn, to a negative impact on consumption. Indeed, there is strong evidence of the cyclical behaviour of bank credit, loan losses and provisions. In a context of strong competitive pressure there is a tendency to loosen bank credit conditions in an upturn first, because contemporaneous non-performing loans are then at a low level and, second, because the market value of collateral increases.

This may contribute to an overextension of credit. The low quality of these loans will only become apparent with the ex-post emergence of default problems, which will tend to appear with a lag of some years. Conversely, loan loss provisions (the counterpart of expected credit risk) have traditionally a pro-cyclical bias as they appear largely linked to the volume of contemporaneous problem assets. Once individual banks run into these problems, the link with wider economic instability is originated by market imperfections in terms of externalities and risk of contagion. Such systemic risk can cause significant macroeconomic costs.

Household financial fragility also has a crucial role in the monetary transmission mechanism via the credit channel. Widespread imperfections in the credit market, such as asymmetric information or imperfect contract enforceability, result for consumers and firms in a wedge between the opportunity cost of internal funds and the cost of external funds. In turn, this external finance premium depends on the monetary policy. Tight monetary policy not only raises market rates of interest, but also raises the external finance premium, thus discouraging investment and consumption. The explanations for this link are twofold. The balance-sheet view, on the one hand, argues that the bridge between monetary policy and the external finance premium is represented by the financial position of borrowers. The bank-lending channel view, on the other hand, focuses on lender's financial status (Bernanke and Gertler, 1995). The credit channel of monetary policy can be expected to be relatively effective in the housing market affecting consumption via residential property (Iacoviello and Minetti, 2003) as well as investment via commercial property (Davis and Zhu, 2004). Moreover, financial liberalization could have played a major role not only directly spurring house prices, but also indirectly, increasing the policy sensitivity of the housing market (Iacoviello, 2004). Even if the ratio of NPL doesn't affect directly inflation, it affects the lending policy of the banks, such that it is an important determinant of the transmission mechanism and is likely to affect the final response to changes in the intervention interest rates.

## 3. A model for household arrears

From a theoretical perspective, with perfect financial markets and without uncertainty, household borrowing can be explained by focusing on demand-side determinants. According to the life-cycle model, therefore, aggregate household debt depends on demographic factors, the expected path of future income and real interest rates. In particular, the life-cycle and permanent income hypotheses consider consumer spending as a function of expected lifetime earnings, consisting of wage earnings and income from assets. To maximise utility, consumers aim to smooth consumption over time, despite varying incomes in different periods. The ability to do so hinges on consumers not facing credit constraints.

In practice, however, consumers may not be able to borrow against expected future income. This happens because uncertainty is inherent to financial markets. Moreover, financial markets are not perfect and suffer from asymmetric information problems. As a result, moral hazard and adverse selection may lead to credit rationing. Therefore the ability to borrow for individuals may be constrained by their current income and their ability to post collateral[1]. Consumption would then vary with current income and net worth. Therefore, credit market developments can be important to explain household consumption. In particular, larger credit availability can lead to an increase in external financing resources and hence in current consumption. At the same time an excessive indebtedness can lead to higher debt-service burden with a possibly negative impact on future consumption.

Adding liquidity constraints into the life-cycle model can, therefore, explain why changes in the structure of the lending market has a significant effect on the amount of household borrowing, and the fact that additional determinants can play a role in determining borrowing decisions (current income, nominal interest rates, disposable collateral, etc.).

Although some life-cycle models incorporated borrowing restrictions, these generally have been imposed exogenously rather than explained as an endogenous response to default risk.

Our theoretical set-up draws from Lawrance (1995), who introduced explicitly a default option into a model of life-cycle consumption to explain how the possibility of default influences the level of consumption, its sensitivity to income, and the type of borrowing constraints likely to emerge. We use her basic set-up, a simple two-period life-cycle model with a default option, and we integrate it with a few extensions[2].

In the model consumers maximise their lifetime expected utility and their consumption preferences are described by:

$$V(C_1, C_2) = U(C_1) + \frac{1}{1+d} E[U(C_2)] \tag{1}$$

where $C_i$ is the consumption in period $i$ , $\delta$ is the subjective rate of time preference and $E(.)$ is the expectation operator, conditional on information available in period one. $U$ is the constant relative risk aversion (CRRA) utility function characterised by $U'>0$, $U''<0$ and $U'(0)$ equal to infinite. Consumption is linked to total income, $Y$, which is composed of labour income and

[1] Credit constraints originate from the presence of asymmetric information between borrowers and lenders, which causes adverse selection and moral hazard problems. For the lenders the best solution to these problems is credit rationing. Collateral plays an important role in credit rationing by reducing the cost of potential defaults, but also acting as a signal of the soundness and post-contractual behaviour of the borrower [Saurina and Jimenez (2004), Stiglitz and Weiss (1981), Bester (1985), Chan and Kanatas (1985), Besanko and Thakor (1987a, b) and Chan and Thakor (1987), Aghion and Bolton (1992) and La Porta et al. (1998)].

[2] Athough this framework was built in the context of consumption decisions, we found it very useful also for our purpose. Consumption and debt decisions are closely linked and the explicit introduction of the default option in the model is an interesting feature of it since allows to make explicit the factors behind lender and borrower´s decisions. Of course the model, and in particular our extension, is quite simple and should be refined in the future but we think is a first step in the right direction.

income derived from own wealth. In the second period total income is uncertain, therefore, consumption is also uncertain. Total income is assumed to be a stochastic process: with probability $q$ period-two income is equal to $Y_L$, a low level of total income, while with probability $1-q$ period-two income equals $Y_H$, a high level of income. Consumers can borrow and lend freely at a risk-free rate $R$, which is exogenous. It is assumed that a borrower can increase period-one consumption by $x_1$ units by giving up $x_2$ units of period-two consumption, with $x_2 = -(1+R)x_1$.

In the presentation of the model we mostly focus on borrowing decisions. However the same model allows to analyse also savings decisions as well. In a way similar to borrowers, savers give up $x_1$ units of period-one consumption in return for $x_2$ units of additional period-two consumption. Since second-period consumption is not certain (because of the uncertain income), individuals maximise their intertemporal expected utility (2):

$$V(x_1, x_2) = U(Y_1 + x_1) + \frac{1}{1+d}[qU(Y_L + x_2) + (1-q)U(Y_H + x_2)], \qquad (2)$$

subject to the budget constraint: $x_2 = -(1+R)x_1$.

At the optimum, the consumer's marginal rate of substitution equals $(1+R)$:

$$MRS = \frac{(1+d)U'(Y_1 + x_1)}{qU'(Y_L + x_2) + (1-q)U'(Y_H + x_2)} = 1 + R\,, \qquad (3)$$

with borrowers characterised by $x_1 > 0$, $x_2 < 0$ and savers by $x_1 < 0$, $x_2 > 0$.

In other words, in equation (2) $x_1$ represents the amount lent ($x_1$<0) or borrowed ($x_1$>0) in period one. And $x_2$ is the amount received as repayment ($x_2$>0) or given as repayment ($x_2$<0) in period two. In the context of this equation, with perfect capital markets, $x_2$ will depend on the market real interest rate ($R$).

However, banks are willing to lend at the riskless rate $R$ only in perfect capital markets, therefore, with no risk of default. When the risk of default is introduced into the model, the borrowers' intertemporal trade-offs and the terms of the loan change. Lawrance assumes that in case of default the bank can claim all income in excess of $Y_L$. This implies that, given that each borrower has $q$ probability of receiving $Y_L$ in period two, there is a $q$ percent chance that the bank will receive no repayment. Obviously, in this case banks are no longer willing to lend at the risk-free rate, $R$. Instead they will charge a competitive borrowing rate at which the expected profits equals zero, so that $1+r = (1+R)(1+rp)$, where $rp$ is the risk premium charged by banks and depends on the collateral provided, the probability of default and market conditions in general. If the bank prices the risk in a correct way, it must hold that $1+rp$ equals $1/(1-q)$, although this is not necessarily the case. Moreover, banks are willing to lend at $1+r$ up to the maximum loan size, $b_{\max}$, which a borrower who receives $Y_H$ in period two can repay:

$$b_{\max} = \frac{1}{1+r}(Y_H - Y_L) .$$

In other words, introducing the default option implies that the borrowing rate exceeds the risk-free rate.

If the default occurs in the low income state, a borrower who accepts $x_1$ in period one has to give up $x_2$ units of period-two consumption only with probability $1-q$. We also assume, without loss of generality, that a share of the loan might be used for real or financial investment[3]. $I$ is the value of the investment in each period and is globally considered as state-dependent[4]. Therefore, the exogenous probability of default depends on the outcome of income and of net wealth together. In case of default the bank can claim the income in excess of $Y_L$ and the financial and real assets. The model by Lawrance assumes that when in period one people borrow only for consumption purposes. We extend the model to include the possibility for people to borrow also to invest in financial or real assets. Implicitly we are admitting that different investment opportunities can offer different real yields. Therefore, the interest charged on the loan shall be different from the expected return of the real or financial investment. In the long run, we expect the rate of return to be associated with the risk of the asset, but in the short term it could also be related to misalignments in the pricing of these assets (e.g. bubbles).

Hence, in case of default, borrowers maximise expected utility (4) subject to the budget constraint (5)[5]:

$$V(x_1, x_2) = U(Y_1 - I_1 + x_1) + \frac{1}{1+d}[qU(Y_L) + (1-q)U[(Y+I)_H + x_2]] \quad (4)$$

[3] This means that in gross terms an individual can borrow at an interest rate that depends on the operation's risk and, at the same time, lend a part (invest) at another interest rate. A net borrower will be the one who borrows more than he lends.

[4] If $I$ is invested in bonds then the return is more or less certain at the bond yield rate $I(1+r)$. If $I$ takes the form of housing investment then the return may be the real house price. If it is in equity then the return may be the share price.

[5] In this second case the expected utility of a non-borrower has a different formulation and is not show here. The full development of the original model can be found in the paper by Lawrance (1995).

$$x_2 = -(1+r)x_1 . \tag{5}$$

With regard to equation (4) we should be aware that it is a two-period model, and we assume that the whole wealth available in period two has to be consumed then. $I_1$ represents the investment on financial or real assets made in period one, and it appears with a minus sign because is part of the income that is not consumed in period one so is not providing any utility in this period. $I_2$ is the market value in real terms of this investment in period two, which will depend on the real yield of this investment. Given that we assume that in the last period the whole wealth is consumed the market value of this investment in real terms in period two ($I_2$) will enter the utility function[6].

The real yield will be different depending on the investment risk (bonds, shares, real assets...). The income as dividends, interest, or rent would enter as income in period two ($Y_2$) and the revaluation of the market value will be included in the term $I_2$. Both, the income and the market value are state dependent. Again, we assume two states: good times where there is no default ($(Y+I)_H > -x_2$ ) and bad times where there is default ($(Y+I)_L < -x_2$ ). In good times, in period two the borrower will have for consumption the high income and the high market value for the investment less the amount to be repaid. In the low state, he will have only the low income, which is the amount that we assumed the lender cannot claim given bankruptcy rules. In the context of this equation, with imperfect capital markets, $x_2$ is the amount to repay for the loan $x_1$ at the real lending interest rate $r$ charged in this operation. The latter, as already explained, depends on the risk free rate ($R$) and the risk premium associated with the risk profile of the borrower, the guarantees provided, etc.

The first order condition of the optimisation process is shown in equation (6), which defines the desired loan size of a borrower facing a $q$ percent probability of default.

$$MRS_B = \frac{(1+d)U'(Y_1 - I_1 + x_1)}{(1-q)U'[(Y+I)_H + x_2]} = 1+r . \tag{6}$$

Extracting the probability of default, $q$, from equation (6) yields:

$$q = \frac{(1+r)U'[(Y+I)_H + x_2] - U'(Y_1 - I_1 + x_1)(1+d)}{(1+r)U'[(Y+I)_H + x_2]} , \tag{7}$$

recalling that $(1+r) = (1+R)(1+rp)$ and that $x_2<0$ and $x_1>0$.

[6] We could assume that a part of the wealth in the last period is kept as a legacy. However this would complicate the notation but lead to the same results.

It follows that the probability of default, which we associate with the chance of falling into arrears, depends on the amount of the loan taken, $x_1$, on current income, $Y_1$ and investment, $I_1$. Arrears depend also on the bank lending rate, $r$, the (uncertain) future income and wealth, which globally depend on the possibility of unemployment and on the development of asset prices. Finally arrears depend on the time preference, $\delta$, which we associate with individuals' expectations about inflation.

# 4. Empirical analysis

## 4.1 The data

Our database consists of quarterly time series for the households sector at country level. The main series we are interested in is the amount of non-performing loans of the household sector. This type of information is not available for every country and, moreover in most countries non-performing loans have been split by sector only recently. Therefore the database only covers seven out of the twelve countries of the euro area being Belgium, France, Finland, Ireland, Italy, Portugal and Spain. These countries all together represent about 70 percent of the euro area's population.

As already mentioned, in order to analyse household financial fragility the crucial piece of information is the amount of non-performing loans of the household sector. Non-performing loans are loans in arrears. These are given different names in different countries: arrears, bad loans, doubtful loans, bad debt. Despite the different labels, they generally represent the same thing: credit in repayment delay for at least three months. What differs across countries is how long non-performing loans are defined as such, i.e. how long it takes before the loan can be judged as non-recoverable and, hence, can be written off as a loss for the credit institution. The timing of this process depends on national regulation. In France and Italy the time before a loan can be written off is particularly long, thus the same loan can be accounted as non-performing for several years while in other countries the same loan will be considered as non-performing for no more than six months. Therefore, the fact that in France and Italy the stock of non-performing loans as a proportion of the total loans' stock is larger seems to a large extent to be related to the long degree of persistency of the same loan among non-performing loans rather than fundamental causes (Moody's, 2003).

The figures on stocks of both non-performing loans of households and total households loans come from country sources. These data are publicly available and are taken from the statistical publications of national central banks. Appendix 3 describes the key variables used in modelling arrears and gives the details about the data sources.

### 4.2 The empirical model

Following the theoretical discussion from section 4, we base our empirical analysis on the following expression, which is a more explicit version of equation (7):

$$npl_{i,t} = f(\,debt_{i,t}\,,\ income_{\,i,t}\,,\ assets_{\,i,t},\ real\ len_{i,t}\,,\ unempl_{\,i,t},\ infl_{\,i,\,t}\,,\ hp_{\,i,t},\ own_{\,i,t}\,) \qquad (7')$$

where $npl_{i,t}$ denotes the log of the ratio of household non-performing loans to total household loans for country *i* at time *t* and proxies the financial fragility of the sector. *Npl* will be a function of $debt_{i,t}$, the log of the ratio of total household debt (including mortgages, consumer loans and credit cards)[6] to household disposable income; of the log of real disposable income per household, $income_{i,t}$; of the log of the ratio of household gross financial assets to disposable income, $assets_{i,t}$; of the real lending interest rate $real\ len_{i,t}$; of the unemployment rate $unempl_{i,t}$ the to account for uncertainty related to future income; and finally the inflation rate $infl_{i,t}$. These are the core variables of the model, i.e. the determinants of the probability of falling into arrears as derived from the theoretical model (cf. last paragraph of section 3). Therefore we believe that these are the variables that should matter in the long-run. However we also added a few other variables that appeared to be relevant in the empirical literature investigating household borrowing. These are the house price index, $hp_{i,t}$ to account for the variability in housing wealth and the ratio of owner-occupied dwellings, $own_{i,t}$, as a proxy of the share of collateralized loans. In line with the discussion of section 2, we think that this latter variable is important in order to account for the distinct effect that collateralized loans might have on the probability of falling into arrears, as opposed to loans without collateral. Given the asymmetric information between lenders and borrowers, collateral can be a signal of high quality borrowers, therefore we can expect a negative relationship between collateral and loan default. The variable $own_{i,t}$ is defined as the ratio of owner occupied dwellings as percentage of total dwelling stock. This ratio includes outright owners and mortgagors.

The ratio of mortgagors over total loans or total dwellings would have been a more accurate measure of collateralized loans but, unfortunately is not available for many countries during the sample period. Therefore, we use *own* as a proxy of the ratio of collateralized loans under

[6] It should be noted that although we consider total households lending, the largest share of it is constituted by mortgages.

the implicit assumption that the proportion of households with mortgages is higher within the group of owner occupiers than within the group of investors who buy a house to rent or speculate. Nonetheless, this variable could capture also other effects that arise from the different tenure structure in the housing market, as for instance the fact that when buying a house owner occupiers are hedging the risk of housing price movements[7] or the different financial profile of people who buy a house to live and those who buy to invest[8].

As mentioned in the previous section, we analyse a dataset including seven euro area countries (N=7) over a period spanning from 1989Q3 to 2004Q2. This panel is unbalanced because for most countries such long series are not available. Therefore, we perform the analysis also on a shorter, but balanced panel spanning from 1998Q2 to 2004Q2 which excludes Finland[9] (thus with N=6). The advantage of using the unbalanced panel is that it has more observations and that the results are less dependent on a specific period. However, we do not expect the results for the two panels to be qualitatively different, such that the analysis of the balanced panel represents a kind of robustness check for the larger dataset.

The use of pooled time series and cross sections allows us to take into account the unobserved and time invariant heterogeneity across countries.

In terms of the econometric model, we interpret (7') as a dynamic model of household arrears, specified as an error correction model. In Fact, we believe that the behaviour of non-performing loans is dynamic in nature in the sense that the past level of non-performing loans can explain the current level. This derives from the fact that the stock of arrears at time t is the accumulated amount of arrears originated in previous periods that was not yet withdrawn from the book-accounts. Moreover the current ratio of non-performing loans will influence the banks lending policy, affecting the future financial conditions and therefore the behaviour of the non-performing loans ratio in the future. The use of this specification is also in line with the existing literature (e.g. Davis, 1995; Whitley et al., 2004). The error correction specification has also the advantage of capturing both short-run and long-run effects on NPL.

Special care is needed in the treatment of the data. In particular, dynamic panel data analysis is characterised by two sources of persistence over time: first, autocorrelation due to the

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7 Investment for speculative purposes is in principle riskier. This might imply a higher cost of the loan independently of the availability of collateral. In fact, solvency regulation asks for different capital requirements when mortgages are given to buy a house to live or for other purposes.

8 We can expect that on average people who buy a house as an investment are wealthier than owner occupiers. As such, they might have a greater buffer to absorb adverse shocks, not only in housing prices but in general. This goes in the opposite direction in terms of risk.

9 For Finland figures for NPLs of households are available only starting from 1999Q3.

presence of a lagged dependent variable among the regressors; and second, autocorrelation due to the individual effects characterising the heterogeneity among the individuals. While it is well known that in typical micro-panels (with large N and small T) the fixed effect (FE) estimator is biased and inconsistent when the model is dynamic, in macro-panels the FE estimator might be less so because T is typically larger (Baltagi and Kao, 2003)[10]. However, given the nature of our data it is essential to detect possible non-stationarity of the series. In such a case, even in macro-panels (with N small and T large) the fixed effect estimator is likely to be biased and inconsistent[11]. If the data were characterised by the presence of unit roots, we would have to check for the presence of possible cointegrating relationships and subsequently express the dynamic model as an error correction model (ECM) constraining the long-run according to the cointegration analysis. According to Pesaran, Shin and Smith (1999), even if the dynamic specification is unlikely to be the same in all countries, it is still possible to pool the estimates treating the model as a system because the efficiency gain from pooling the data outweighs the losses from the bias introduced by heterogeneity (Baltagi and Griffin, 1997). In such a case, it has been shown in Kao and Chen (1995) that the OLS in panel cointegrated models is asymptotically normal, but biased. Therefore, alternative estimators have been suggested for the estimation of the long-run, like the fully modified OLS (FMOLS).

We will estimate a model in the following (semi) log-linear form:

$$\Delta npl_{it} = \sum_{j=0}^{p-1} \gamma_{ij} \Delta z_{i,t-j} + \alpha_i (npl_{i,t-j} - \beta_i ' z_{i,t-j}) + \mu_i + \varepsilon_{it} \qquad (8)$$

where $t = 1, \ldots, T$ and $i = 1, \ldots, N$, $npl_{it}$ is the ratio of NPL, $z_{i,t-j}$ is a vector of explanatory variables as described in (7'), $\beta_i$ represent the long-run parameters and $\alpha_i$ are the equilibrium adjustment parameter (ecm). Finally, $\mu_i$ are the fixed effects; however we will treat these parameters as common across countries according to the mean group restriction.

However, for expression (8) to be meaningful, the existence of a long-run equilibrium must be assessed. Thus, in the next section we will first analyse the nature of individual series and test for panel cointegration using the test developed by Pedroni (1999 and 2004).

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[10] In order for the consistency of the estimator to hold the disturbances of the model must be i.i.d., but this does not hold when the number of periods is finite.

[11] Binder *et al*. (2000) show that also the GMM estimator based on the standard orthogonality condition breaks down if the underlying series have unit roots.

## 5. Panel cointegration analysis

A graphical inspection of the series suggests possible non-stationarity and indeed, both the time-series and the panel unit roots tests do not allow rejecting the hypothesis of non-stationarity. Table A1 in Appendix 1 shows the results for some unit root panel tests, which seem to have more power in the case of pooled cross-section and times series. In general we find that for all the series used have unit roots. The tests results allow also excluding the presence of variables integrated of order two.

Having assessed that the series are integrated of order one, the next issue is the existence of a long-run equilibrium; to do that we use the Pedroni cointegration test, as already mentioned in the previous section. The Pedroni test is based on a panel unit root test of the residuals estimated from the general regression:

$$y_{it} = q_i + l_i t + b_i z_{it} + e_{it}$$

where $\theta_i$ are the scalars denoting fixed effects and $\lambda_i$ are the unit specific linear trend parameters. The test has an asymptotically normal distribution (as the cross section dimension increases) and allows for heterogeneity among the panel members. The test is based on seven statistics, four of which are called panel statistics and pool the autoregressive coefficient in the residual based test, while the remaining three statistics, the group statistics, take the average, hence allowing for more heterogeneity. The panel tests are the panel $v$-statistic, the panel $\rho$-statistic and a non-parametric and parametric panel $t$-statistics. The group tests are the group $\rho$-statistic and the two group $t$-statistics. If these statistics allow detecting a stable long-run relationship linking the regressors, their coefficients and their respective significance might be estimated with the FMOLS[12].

Table 1 shows the results of the test for the existence of a cointegrating relationship linking household *npl*, *debt*, *income*, *infl*, *real len* and *unempl*. We performed the test both on the unbalanced panel and on the shorter, balanced panel. As the table shows, in the former case we can reject the null of no cointegration only in three cases, while in the case of the balanced panel we reject in five out of the seven tests statistics of the Pedroni test. This evidence

[12] Fully Modified OLS.

globally does not appear sufficient to discard the existence of a stable long-run relationship for arrears[13].

**Table 1: Pedroni cointegration tests[14]**

| | *Unbalanced panel (N=7)* | | *Balanced panel (N=6)* | |
|---|---|---|---|---|
| | *Stat. value* | *p-value* | *Stat. value* | *p-value* |
| *Panel v* | -0.23 | 0.59 | 2.11 | 0.03 |
| *Panel ρ* | -0.40 | 0.69 | -0.39 | 0.70 |
| *Panel pp t* | -3.08 | 0.00 | -6.28 | 0.00 |
| *Panel t* | -0.97 | 0.28 | -2.04 | 0.04 |
| *Group ρ* | 1.30 | 0.90 | 0.95 | 0.83 |
| *Group pp t* | -3.92 | 0.00 | -6.12 | 0.00 |
| *Group t* | -2.06 | 0.04 | -3.18 | 0.00 |

Therefore, we may estimate the significance of the long-run dynamics using the FMOLS estimator developed by Pedroni. This allows two distinct types of estimations. The first is based on the 'within dimension' of the panel and provides estimations at individual level. The second is the panel group FMOLS estimator which pools the data along the 'between dimension'. The FMOLS allows addressing some type of heterogeneity typical in dynamic cointegrated panels. In particular there can be two sources of heterogeneity: one is in the form of the fixed effect, reflecting differences in mean level among the variables of different countries and can be modelled by means of specific intercepts (time dummies). Hence we use common time dummies to capture temporal cross-sectional dependency[15]. The second source of heterogeneity stems from differences in which countries respond to short-run deviations from equilibrium that develop in response to stochastic disturbances.

The panel group FMOLS estimator allows for greater flexibility in presence of heterogeneity of the cointegrating vectors because it does not require a common cointegrating vector under the alternative hypothesis. Moreover its point estimates can be interpreted as the mean value

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[13] We are aware that in small panels - like in this case - the power of the test can decrease in a non negligible way. Despite this fact, Pedroni (2004) shows that when N<T and T is relatively small, the group t and the panel t are the most powerful statistics, thus given that they reject we believe that concluding in favour of cointegration is the best choice.

[14] We are grateful to P. Pedroni for making his RATS procedures available to us.

[15] In presence of cross-section cointegration the power of the Pedroni cointegration test can be altered. Although we were unable to test explicitly cross-unit cointegration, we carried out a unit-by-unit cointegration analysis and found the same rank across units, which should limit the distortion effect. Moreover, according to Banerjee et al. (2004) the size of the distortion when N is small is relatively limited.

for the cointegrating vectors and suffer from much lower small-size distortion than the within estimator. Table 2 illustrates the resulting long-run relationship linking NPL to the macroeconomic variables for the group of considered euro area countries. For the reasons just explained in the table we report only the panel group estimation. The individual country results, however, are illustrated in Appendix 2. As mentioned in section 4.2 the variables that explain arrears in the long run are the core variables, derived directly from the theoretical model. The only variable derived from the structural model that does not appear here is the ratio of household assets[15].

**Table 2: Panel Group FMOLS cointegration estimation**

| | *Dependent variable: npl* | | | |
|---|---|---|---|---|
| | ***Unbalanced panel*** *N=7; obs=221* | | ***Balanced panel*** *N=6; obs.150* | |
| | *Coeff.* | *p-value* | *Coeff.* | *p-value* |
| *debt* | 0.93 | 0.00 | 0.40 | 0.00 |
| *income* | -1.48 | 0.13 | -0.16 | 0.50 |
| *infl* | 0.23 | 0.00 | 0.05 | 0.00 |
| *real len* | 0.28 | 0.00 | 0.03 | 0.00 |
| *unempl* | 0.07 | 0.00 | 0.04 | 0.11 |

The second column of Table 2 shows the panel group estimated parameters for the unbalanced panel. We can notice that the household ratio of debt to income displays a high and positive impact on the probability of falling into arrears in the long-run, while the effect of household disposable income appears also to be large, but negative (although not significant), thus largely compensating the debt effect. Income is the only wealth component that appears in the long-run equation indicating that for most of the indebted households the other components (financial and real wealth) are not really important. This might suggest that these households are probably not the main holders of financial assets or do not have dwellings for investment but only to occupy.

[15] This variable is not in the long run because its inclusion did not allow accepting cointegration and moreover was not significant.

The inflation rate has a positive semi-elasticity equal to 0.23% and is significant. On theoretical grounds the expected sign of this variable is ambiguous. One can expect a positive effect on arrears if the contracts are characterized by floating interest rates, but also a negative effect in real terms given the nominal nature of the debt, although these arguments should play a more important role in the short run given that both rely on market rigidities and unexpected shocks. However, over the last years low levels of inflation have been associated with less volatile inflation, so that surprises are less likely to occur, thus decreasing the likelihood of falling into arrears. This argument would be more consistent in the long run given that is linked with the perceived uncertainty. In the long run we expect contracts to adjust to inflation, so the effect of the cost of borrowing is captured by the real interest rate. Inflation in the long run is capturing the effect of a less volatile price regime and therefore less uncertainty. The positive estimated coefficient, therefore, suggests that lower volatility has contributed to the better performance of the ratio of arrears.

The real lending rate, as expected, has also a positive and significant impact on arrears, meaning that an increase in the level of real interest rates also implies an increase on the level of NPL.

As expected, the unemployment rate displays a positive effect on arrears to indicate the uncertainty of future income. It should be also noted that with the exception of disposable income all the variables are strongly significant[17].

The panel group coefficients for the balanced panel are displayed in the forth column of Table 2. In general the size of the coefficients is much smaller in this case. This might be related to the smaller power of the estimation because of fewer observations available. Again income is not significant, but in this case unemployment is also insignificant. Also in this case the significance of the coefficient for income is not affected by the presence of unemployment, so that the same considerations about households' behaviour hold. It should be also noticed that in this case the income coefficient is much smaller with respect to one from the unbalanced panel. This suggests that when limiting the time period to the most recent past the increase in income was not sufficient to compensate the increase in the debt ratio.

[17] Notice that if households discount their expectations rationally at time t, income and unemployment should capture the same thing. However, the presence of unemployment in the long-run relationship appeared to be necessary for the cointegration to hold and to be meaningful. Moreover the non-significance of income was not affected by the presence of unemployment. This suggests that household might not fully take into account their expectations with respect to the future.

The final step consists of estimating the error correction model with the short- and long-run on arrears. Table 3 shows the estimation results based on the SUR method[16], where the variables explaining the short-run adjustment are expressed in differences with respect to the previous year (Δ). The choice of taking the seasonal difference is motivated by two factors. First, in the data section we mentioned that the ratio of non-performing loans, our main object of interest, is a highly persistent measure because of the way NPL are defined, such that the variability of this ratio with respect to the previous quarter might be very small. Second, we believe that households do not update their decisions and expectations very often; in this sense the difference with respect to the previous year might better mirror household behaviour. However, we are aware that the use of the series in difference with respect to previous year might introduce autocorrelation. To solve this problem the error-correction model is estimated with a SUR method that corrects both for period heteroskedasticity and correlation of observations within the same cross-section. Similarly, the long term is expressed with the variables at t-4.

The results for the dynamic specification accord with our expectations and are well determined. The long-run here is represented by the *ecm* term which is the cointegrating vector previously estimated and described in Table 2. The adjustment to the long-run equilibrium is 0.09, so that after one year less than 40% of the adjustment has taken place and it takes around two years and a half to go back to the long-run equilibrium.

For the short-run we adopted a general-to-specific approach, thus we tried several specifications including the core variables that are also present in the long-run, plus the additional variables.

We first analyse the unbalanced panel. As already mentioned, this includes one additional country with respect to the balanced one (Finland) and has many more observations, therefore is the one that we consider as more reliable[17]. With regard to the short-term determinants of arrears, the short-run elasticity for household disposable income is negative and larger than one, similarly to the long-run. Credit rationing justifies this variable in the short-run. The fact that it might not be possible to borrow against the future income explains why consumption depends on changes in income, or more accurately, on changes in the liquidity position. At the

[16] Seemingly Unrelated Regressions.

[17] Given the development´s speed in the financial sector during the sample period (securitizations, credit derivatives instruments, strcutured products, intergenerational loans, etc) we cannot exclude some strcutural breaks in the model. However given the sample size we found not appropiate to split the sample because the estimation would have been non reliable given the relatively small size of out sample. Moreover we think that these developments are the result of a continuos process more than a one-off factor and the timing and pace of this process is not the same in every country therefore it is complicate to look for a clear break.

same time this variable also affects the long-run via human wealth expectations. As long as a change in income is viewed as permanent, it means a change in wealth, hence with an impact in the long-run.

**Table 3: Dynamic model estimation**

| | Dependent variable: $\Delta npl_t$ | | | |
|---|---|---|---|---|
| | Unbalanced panel (N=7) | | Balanced panel (N=6) | |
| | *Coeff.* | *St. err.* | *Coeff.* | *St. err.* |
| $\Delta income_t$ | -1.654*** | 0.650 | -1.006* | 0.536 |
| $\Delta assets_t$ | -0.238*** | 0.089 | -0.088 | 0.067 |
| $\Delta nom\ len_t$ | 0.021* | 0.013 | 0.014 | 0.015 |
| $\Delta hp_t$ | -0.004 | 0.003 | -0.008*** | 0.002 |
| $\Delta own_t$ | -0.087*** | 0.030 | -0.516** | 0.023 |
| $Ecm_{t-4}$ | -0.092*** | 0.029 | -0.486*** | 0.086 |
| *constant* | 1.288*** | 0.411 | 1.143*** | 0.206 |
| *BE* | -0.016 | | -0.239 | |
| *ES* | -0.106 | | -0.530 | |
| *FI* | -0.276 | | | |
| *FR* | 0.060 | | 0.307 | |
| *IE* | 0.010 | | -0.151 | |
| *IT* | 0.169 | | 0.661 | |
| *PT* | 0.077 | | -0.047 | |
| | $R^2$ = 0.62<br>no. obs =193 | | $R^2$ = 0.76<br>no. obs =108 | |

Note: ***, **, * denote respectively significance at 1, 5 and 10%.

Financial wealth also displays a negative impact and reflects the possibility to use liquid assets as a buffer: ten percent larger availability of financial assets (as a ratio of income) decreases the probability of falling into arrears by 2.4 percent. The fact that this variable is significant only in the short-run suggests that it is typically used for short-term adjustments.

The nominal lending rate appears with a positive sign and captures both the effect of inflation and of the real lending rates. As already noted, in the short run because of market rigidities depending on the market structure, inflation might also play a role in the real cost of the loan, in the same direction as the real interest rate. With floating interest rate contracts[18] then inflation is transmitted to the cost of the loan more rapidly than to the salaries, and then it has a real impact in the financial position of the household. Given that the effect goes in the same

[18] In the euro area almost half of lending contracts are based on floating interest rates.

direction and the observable variable is nominal interest rates we opted for using this variable in the short run as a proxy for the cost of the loan.

The ratio of owner-occupied houses also results highly significant and negative and accounts for the proportion of collateralized loans which are usually less risky, while house prices appear to have a very small effect, moreover, are not significant.

Finally, in the model we also used the spread to account for supply conditions. In particular, the spread should represent the risk premium charged by banks. However this variable was never significant, so was not included in the final specification. Note also that the coefficient for the constant is quite high and positive indicating that there are relevant country-factors that cannot be captured by the selected variables, but that tend to increase financial fragility. In fact the table also shows the individual fixed effects for which, however, the significance is not available[19]. It can be seen that in Finland and to a lesser extent in Belgium and Spain the impact on arrears is smaller than the average picture for the whole sample. This indicates that the household living in one of these countries are less likely to fall into arrears, while on the contrary those leaving in Italy are the most likely to run into financial problems. However, as we highlighted in section 4.1, most differences between countries seem to be related to the structural supply-side factors, the very different legal and fiscal environment[20] and, last but not least, to the different definition of NPL, which directly affects the ratio of arrears.

The last two columns of Table 3 display the results for the balanced panel. Comparing these columns with the ones referring to the unbalanced panel we remark that for disposable income, financial assets and the nominal interest rate the impact on arrears is markedly smaller, moreover the latter two are not significant. Conversely, the coefficient for *own* and the error correction term are much larger.

As opposed to the unbalanced panel including Finland, here house prices are also relevant, although their effect is still quite weak. An increase in house prices might be viewed by households as an increase in wealth, so that the higher market value of housing stock due to rising house prices has an attenuating impact on arrears. Higher house prices in connection

[19] The fixed effects estimates sum to zero and should be interpreted as deviations from an overall mean. They do not have reported standard errors because the program treats them as nuisance parameters for the purpose of estimation.

[20] Examples of determinants at country level are the typical loan length, the quality of risk management, the loan-to-value ratios, the technological advances, and institutional changes. All these variables are very difficult to measure overtime; that is why we could not measure their impact directly.

with an increase in the ratio of owner-occupied properties might also account for the easing in credit conditions enhanced by the increasing value of collateral.

Note that we also tried the equivalent specifications with simple differences (not shown here). No major differences could be noticed for the unbalanced panel in terms of size and significance of the coefficients. For the balanced panel, however, only income, the error correction term and the constant were significant. In any case, as already mentioned we believe that the model expressed in yearly differences described above better represents household behaviour and thus is more informative.

A general conclusion we can draw from the empirical results presented above is that the recent increase in the share of debt taken by households had a negative impact on their capability to reimburse it. Therefore, the household sector in general is characterised by a riskier position in financial terms. Even though in the short-term several factors might help attenuating financial problems, it will take a while before the imbalance can be reabsorbed.

## Conclusion

The sharp increase in the debt to income ratio in developed countries has raised concerns about a parallel rise in household financial fragility that would affect macroeconomic and financial stability. One of the aims of this paper is to understand to which extent the current increase in the debt to income ratio constitutes a movement towards a new equilibrium or, rather, is related to a riskier financial position for the sector. To highlight the issue we analysed an empirical model for the ratio of non-performing loans, which constitutes the best indicator available for financial fragility. We derived the empirical specification from a life-cycle model which allows for the probability of default. Then we used a panel of seven (or six) euro area countries and estimated an error-correction model. We found that the set of variables included in the model tends to explain a good proportion of the variation of arrears, indicating that the model captures quite well the factors behind arrears' developments. The model suggests that, in the long-run, an increase in the ratio of indebtedness to income is associated with higher levels of arrears. However, if the rise in the debt ratio is accompanied by a rise in disposable income, the negative effect is more than offset. This suggests that increases in real disposable income would allow -other things equal- relatively higher increases in the debt to income ratio combined with a same level of the ratio of arrears. Monetary conditions are also important because rising inflation and lending rates significantly worsen financial conditions. However, these effects might be difficult to perceive in the short-run given that the model needs around two years and a half for a complete transmission of possible shocks.

Moreover, in the short-run the role of financial wealth and housing wealth (proxied by the house price index) tends to confirm the idea that wealth is used as a buffer in case of unexpected shocks. Even though, on the one hand, housing wealth, being less liquid, plays a minor role in relieving financial stress as compared to financial assets, on the other hand, it still helps, in accordance with the view that collateral can be used to overcome asymmetric information problems.

In general, however, we can conclude that the recent rise in the debt ratio has put the household sector a riskier financial position. In fact, the main attenuating impact on such risk is played by rises in income, but in the countries considered the evidence is that income has grown less than the ratio of debt. At the same time other possible short-term adjustments are absorbed only slowly.

Finally, differences between countries seem to be very important and globally exacerbate household financial conditions. These differences are likely to be related to institutional characteristics and structural supply-side factors, which play a key role in determining the stability of financial conditions and, therefore, the equilibrium level of household debt. However, besides the relevance of country specific factors, we believe that considering the household sector from a euro area perspective can provide useful pieces of information for the conduct of the common monetary policy as well as for the analysis of the euro area financial stability conditions.

## References


Aghion, P. and P. Bolton (1992), ‘An Incomplete Contracts Approach to Financial Contracting’, *Review of Economic Studies*, Vol. 59, pp. 473-494.

Antzoulatos, A. A. (1996), ‘Consumer credit and consumption forecast’, *International Journal on Forecasting,* Vol. 12, pp. 439-453.

Bacchetta, P. and S. Gerlach (1997), ‘Consumption and Credit Constraints: International Evidence’, *Journal of Monetary Economics,* Vol. 40*,* pp. 207-238.

Baltagi, B. and J. Griffin (1997), ‘Pooled estimators vs. their heterogeneous counterparts in the context of dynamic demand for gasoline, *Journal of Econometrics*, Vol. 77, pp. 303-27.

Baltagi, B. and C. Kao (2003), ‘Nonstationary panels, cointegration in panels and dynamic panels: a survey’, *Advances in Econometrics*, vol.15, p. 7-51, Nonstationary Panels, Panel Cointegration And Dynamic Panels, JAI Press.

Banasik, J. Crook, J. and L. Thomas (1999), ‘Can we score by usage?’, *Credit Research Centre Working Paper Series 99/7*.

Banerjee, A. Marcellino, M. and C. Osbat (2004), ‘Some Cautions on the Use of Panel Methods for Integrated Series of Macroeconomic Data’, *Econometrics Journal*, Vol. 7, pp. 322-340.

Bank of England (2002), *Financial Stability Review*, December, p. 68.

Barnes, S. and G. Young (2003), ‘The rise of households debt: assessing its causes and sustainability’, *Bank of England Working Paper n. 206.*

Bernanke, B. and M. Gertler (1995), ‘Inside the black box: the credit channel of the monetary policy transmission’, *National Bureau of Economic Research Working Paper 5146.*

Besanko, D. and A. V. Thakor (1987a), ‘Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets’, *International Economic Review,* Vol. 28, pp. 671-689.

— (1987b), ‘Competitive Equilibria in the Credit Market Under Asymmetric Information, *Journal of Economic Theory*’, Vol. 42, pp. 167-182.

Bester, H. (1985), ‘Screening vs. Rationing in Credit Markets with Imperfect Information’, *American Economic Review,* Vol. 75, pp. 850-855.

Boone, L., Girouard, N. and I. Wanner (2001), ‘Financial Market Liberalisation, Wealth and Consumption’, *OECD Working Paper ECO/WKP 34.*

Breedon, F. J. and M. A. S. Joyce (1993), ‘House prices, arrears and possessions: A three equation model for the UK’, *Bank of England Working Paper no. 14*.

Campbell, J. Y. and G. N. Mankiw (1989), ‘Consumption, Income and Interest Rates: Reinterpreting the Time Series Evidence’, *in Olivier J. Blanchard and Stanley Fisher, eds., NBER Macroeconomics Annual 1989,* Cambridge MA: MIT Press, pp. 185-216.

Carroll, C. D. and Dunn W. D. (1997), ‘Unemployment Expectations, Jumping (S,s) Triggers, and Household Balance Sheets’, *in Ben S. Bernanke and Julio J. Rotemberg, eds., NBER Macroeconomics Annual 1997,* Cambridge, MA: MIT Press, pp. 165-217.

Carroll, C. D. (1997), ‘Buffer Stock Saving and the Life Cycle/Permanent Income Hypotheses’, *Quarterly Journal of Economics,* Vol. 112, pp. 1-55.

Chan, Y. S. and G. Kanatas (1985), ‘Asymmetric Valuation and the Role of Collateral in Loan Agreements’, *Journal of Money, Credit and Banking,* Vol. 17, pp. 85-95.

Chan, Y. S. and A. V. Thakor (1987),’Collateral and Competitive Equilibria with Moral Hazard and Private Information’, *Journal of Finance,* Vol. 42, pp. 345-364.

Coles, A. (1992), ‘Causes and characteristics of arrears and possessions’, *Council of Mortgage Lenders Housing Finance*, 13, pp. 10-12.

Davis, P. (1995), ‘Debt, Financial fragility and Systemic Risk’ *Clarendon Press. Oxford*.

Davis, P. and H. Zhu (2004), ‘Bank lending and commercial property cycles: some cross-country evidence’, *BIS Working Papers no. 150*.

De Bondt, G. (1999), ‘Credit channels and consumption in Europe: empirical evidence’, *BIS Working Paper no. 69.*

Deaton, A. (1991), ‘Savings and Liquidity Constraints’, *Econometrica,* Vol. 59, pp. 1221-1248.

Debelle, G. (2004), ‘Household debt and the macroeconomy’, *BIS Quarterly Review,* March 2004, pp.51-64.

European Central Bank (2003), ‘Structural factors in the EU housing markets’, Frankfurt am Main.

Girouard, N. and S. Blondal (2001), ‘House prices and economic activity, *OECD Working Paper,* no. 279.

Group of Ten (2003), ‘Turbulence in asset prices: the role of micro policies’, *Report of the Contact Group on Asset Prices.*

Housing statistics in the European Union (2003), National Agency for Enterprise and Housing, Denmark.

Iacoviello, M. (2004), ‘House prices, Borrowing constraints and Monetary Policy in the Business Cycle’, Forthcoming in *American Economic Review*.

Iacoviello, M. and R. Minetti (2003), ‘The credit channel of monetary policy: evidence from the housing market’*, BC Working Paper no.541.*

Japelli, T. and M. Pagano (1989), ‘Consumption and Capital Market Imperfections: An International Comparison’, *American Economic Review,* Vol.79, pp. 1088-1105.

Kao, C. and B. Chen (1995), ‘On the estimation and inference for cointegration in panel data when the cross-section and time-series dimensions are comparable’, Manuscript, Centre for Policy Research, Syracuse University.

KBC (2003), ‘Het gezinsvermogen in de branding van het beursklimaat’, *Economic Research Notes*, no.9, 21 mei.

King, M.A. (1996), ‘Imperfections and the consumption function’. *Scandinavian Journal of Economics,* Vol. 88, pp.59-80.

LaCour-Little, M. (1999), ‘The Evolving Role of Technology in Mortgage Finance’ *OLIN Working Paper no. 99-02.*

La Porta, R. et al. (1998), ‘Law and Finance’, *Journal of Political Economy,* Vol. 106, pp. 1113-1155.

Lawrance, E. (1995), 'Consumer default and the life cycle model', *Journal of Money, Credit and Banking,* Vol. 27/4, Part 1.

Ludvigson, S. (1999), 'Consumption and credit: A model of time-varying liquidity constraints', *The Review of Economics and Statistics,* August 1999, pp. 434-447.

Maki, D. M. (2000), 'The Growth of Consumer Credit and the Household Debt Service Burden', *Board of Governors of the Federal Reserve System Finance and Economic Discussion Paper 2000-12*.

Mester, L. J. (1997), 'What's the point of credit scoring?', *Federal Reserve Bank of Philadelphia Business Review*, September/October, pp. 3-16.

Moody's (2003), 'Non-performing Loans and Loan-Loss Provisioning Policies in Various European Countries', Special Comment, October.

Morgan, D. P. and I. Toll (1997), 'Bad debt rising', *Federal Reserve Bank of New York Current Issues in Economics and Finance,* Vol. 3(4), pp. 1-5.

Murphy, R. G. (1998), 'Household debt and consumer spending', *Business Economics,* July 1998, pp. 38-42.

Pedroni, P. (1999), 'Critical values for cointegration tests in heterogeneous panels with multiple regressors', *Oxford Bulletin of Economics and Statistics*, Vol.61, pp. 653-70.

Pedroni, P. (2004), 'Panel cointegration, asymptotic and finite sample properties of pooled time series tests with application to PPP hypothesis, *Econometric Theory*, Vol.20, pp. 597-625.

Pesaran, M.H., Shin, Y. and R. Smith (1999), 'Polled mean group estimation of dynamic heterogeneous panels', *Journal of the American Statistical Association*, Vol.94, pp. 621-34.

Rademaekers, K. and J. Vuchelen (1999), 'Het Belgische gezinsvermogen, 1970-1997', *VUB Documentatie-blad*, september/oktober 1998, pp. 41-64.

Saurina, J. and G. Jiménez (2004), ´Collateral, type of lender and relationship banking as determinants of risk´, *Banco de España, Documento de trabajo, nº 0414.*

Saurina, J., Jiménez, G. and V. Salas (2004), ´Determinants of Collateral´, *Banco de España, Documento de trabajo, nº 0420.*

Stiglitz, J. E. and A. Weiss (1981), 'Credit Rationing in Markets with Imperfect Information', *American Economic Review*, Vol. 71, pp. 393-410.

van den Noord, P. (2003), 'Tax incentives and house price volatility in the euro area: theory and evidence', *OECD Economics Department Working Papers no. 356*.

Waller, N. (1988), 'Residential mortgage default: a clarifying analysis', *Housing Finance Review,* Vol.7, pp. 321-333.

Whitley, J., Windram, R. and P. Cox (2004), 'An empirical model of household arrears', *Bank of England Working Paper no. 214.*

Zeldes, S. P. (1989) 'Consumption and Liquidity Constraints: An Empirical Investigation'. *Journal of Political Economy,* Vol. 97(2), April, pp. 305-346.

## Appendix 1: Unit root analysis

Table A1 displays the results of some panel data unit root tests on the variables used in the empirical model. The first two tests, the Levin, Lin and Chu (LLC) and the Hadri test, assume that there is a common unit root process, so that the persistence parameter (the autoregressive coefficient usually denominated as $\rho_i$) is common across cross-sections (hence, $\rho_i = \rho$ for all $i$). While the LLC test is based on the null hypothesis of unit root, the Hadri test is based on the null of no unit root[21]. Conversely, the Im, Pesaran and Shin (IPS) test allows for individual unit root processes and, therefore, $\rho_i$ may vary across cross-sections and combines the individual unit root tests to derive a panel specific result. The IPS employs as null hypothesis the presence of a unit root, with the alternative that some of the individual processes are stationary.

**Table A1: Panel unit root tests**

| | Levin, Lin, Chu | | Hadri | | Im, Pesaran, Shin | |
|---|---|---|---|---|---|---|
| | t*-stat | p-value | Z-stat | p-value | W-stat | p-value |
| *npl* | -2.71 | 0.00 | 10.01 | 0.00 | 0.42 | 0.66 |
| Δ*npl* | -3.77 | 0.00 | 2.17 | 0.02 | -5.68 | 0.00 |
| *debt* | -0.84 | 0.20 | 9.05 | 0.00 | 1.76 | 0.96 |
| Δ*debt* | -6.20 | 0.00 | 4.93 | 0.00 | -6.28 | 0.00 |
| *income* | -3.18 | 0.00 | 11.41 | 0.00 | 0.19 | 0.57 |
| Δ*income* | -1.99 | 0.02 | 3.25 | 0.00 | -5.60 | 0.00 |
| *assets* | 1.29 | 0.10 | 5.65 | 0.00 | 1.53 | 0.06 |
| Δ*assets* | -8.40 | 0.00 | 0.92 | 0.18 | -11.59 | 0.00 |
| *infl* | -0.59 | 0.28 | 1.73 | 0.04 | -2.42 | 0.01 |
| Δ*infl* | -2.31 | 0.01 | 0.90 | 0.18 | -4.87 | 0.00 |
| *nom len* | -1.65 | 0.05 | -2.43 | 0.01 | 5.90 | 0.00 |
| Δ*nom len* | -4.34 | 0.00 | -0.30 | 0.62 | -6.20 | 0.00 |
| *real len* | -0.10 | 0.46 | 7.34 | 0.00 | 0.35 | 0.64 |
| Δ*real len* | -8.10 | 0.00 | 0.53 | 0.30 | -9.90 | 0.00 |
| *unempl* | -0.98 | 0.16 | -0.67 | 0.00 | 7.26 | 0.25 |
| Δ*unempl* | -3.10 | 0.00 | - | - | - | - |
| *hp* | 2.41 | 0.99 | 4.98 | 0.00 | 8.47 | 1.00 |
| Δ*hp* | -5.52 | 0.00 | 3.07 | 0.00 | -8.68 | 0.00 |
| *own* | 2.52 | 0.99 | 8.60 | 0.00 | -1.92 | 0.03 |
| Δ*own* | -9.31 | 0.00 | - | - | - | - |

[21] This test is very similar to the KPSS unit root test in the case of time series.

Table A1 shows the tests on the series in levels and the general evidence one can extract is that all the series appear to have unit roots. Only for the nominal lending rate the tests provide unclear results. As additional evidence, we also performed the Breitung panel unit root test (not shown here) which clearly accepted the null of unit root (t-stat = 0.24, p-value: 0.60) such that the evidence does not appear sufficient to exclude the unit root.

We also performed the same tests on the series in first differences and the results allow excluding integration of order two.

## Appendix 2: Country cointegration relationships

**Table A2: Individual FMOLS results**

| | | *Dependent variable: npl* | | | |
|---|---|---|---|---|---|
| | | *Unbalanced panel (N=7)* | | *Balanced panel (N=6)* | |
| Country | Variable | Coefficient | t-statistic | Coefficient | t-statistic |
| Belgium | debt | -2.81 | ( -12.14 ) | -1.72 | ( -18.61) |
| | income | 3.94 | ( 7.29 ) | 0.02 | ( 0.09 ) |
| | infl | -0.14 | ( -2.13 ) | 0.06 | ( 3.51 ) |
| | unempl | -0.14 | ( -5.41 ) | -0.07 | ( -7.27 ) |
| | real len | 0.02 | ( 0.55 ) | 0.03 | ( 1.76 ) |
| Spain | debt | -1.70 | ( -3.38 ) | -0.05 | ( -0.10 ) |
| | income | -2.84 | ( -4.03 ) | -1.40 | ( -1.52 ) |
| | infl | -0.01 | ( -0.08 ) | -0.09 | ( -1.56 ) |
| | unempl | -0.06 | ( -4.19 ) | 0.02 | ( 1.31 ) |
| | real len | 0.07 | ( 0.96 ) | -0.08 | ( -1.32 ) |
| Finland | debt | 6.64 | ( 6.77 ) | | |
| | income | -24.29 | ( -17.44 ) | | |
| | infl | 1.72 | ( 12.83 ) | | |
| | unempl | -0.07 | ( -3.68 ) | | |
| | real len | 1.81 | ( 13.68 ) | | |
| France | debt | -1.08 | ( -2.89 ) | 0.07 | ( 0.26 ) |
| | income | 0.33 | ( 0.53 ) | -1.75 | ( -1.67 ) |
| | infl | -0.11 | ( -2.64 ) | -0.02 | ( -0.93 ) |
| | unempl | 0.02 | ( 0.31 ) | 0.00 | ( 0.04 ) |
| | real len | -0.02 | ( -0.55) | -0.01 | ( -0.28 ) |
| Ireland | debt | 0.35 | ( 1.02 ) | -0.30 | ( -0.55 ) |
| | income | 1.76 | ( 1.42 ) | -0.58 | ( -0.33 ) |
| | infl | 0.14 | ( 5.45 ) | 0.09 | ( 2.71 ) |
| | unempl | 0.24 | ( 5.92 ) | 0.04 | ( 0.59 ) |
| | real len | 0.06 | ( 2.02 ) | 0.11 | ( 3.04 ) |
| Italy | debt | 5.35 | ( 5.38 ) | 5.39 | ( 4.19 ) |
| | income | 8.71 | ( 9.58 ) | 1.31 | ( 0.98 ) |
| | infl | 0.13 | ( 1.47 ) | 0.29 | ( 7.86 ) |
| | unempl | 0.43 | ( 15.57 ) | 0.17 | ( 4.70 ) |
| | real len | 0.06 | ( 0.98 ) | 0.11 | ( 7.41 ) |
| Portugal | debt | -0.26 | ( -3.00 ) | -1.03 | ( -6.55 ) |
| | income | 2.06 | ( 5.95 ) | 1.47 | ( 2.41 ) |
| | infl | -0.15 | ( -4.43 ) | -0.05 | ( -1.53 ) |
| | unempl | 0.05 | ( 5.22 ) | 0.06 | ( 4.07 ) |
| | real len | -0.04 | ( -2.67 ) | -0.01 | ( -0.51 ) |

## Appendix 3: Data sources

**Belgium**

NPL: Arrears on consumer credit and mortgages to individuals, from NBB, Centrale des crédit aux particuliers.

Unemployment: Unemployment rate from OECD database (series code MEI.Q.BEL.UNRTRG01.STSA).

Real lending rate: Nom. lending rate – Inflation

Nom. lending rate: Lending rate, IFS database.

Inflation: (CPI index (t) - CPI index (t-4))/CPI index (t-4), CPI index from IFS database.

Debt: Financial liabilities of individuals, Ch. 16 Statistical Bulletin NBB.

Income: Household disposable income, from National Accounts (Belgostat) interpolated using the quarterly variation of Gross National Income (Eurostat).

Real wealth: Total household wealth - net financial wealth. Total household wealth comes from Rademaekers K. and J. Vuchelen (1999), KBC (2003) and own estimates, interpolated using the quarterly variation of house prices (ECB).

Financial wealth: Financial assets from Annual Financial Accounts interpolated using the quarterly variation of stock prices (BEL20 index) + Debt.

HH: Number of households, Eurostat (quarterly frequency obtained by linear interpolation of annual data).

Own: Ratio of owner occupied houses, from "Housing Statistics in the European Union 2003" National Agency for enterprises and housing.

HP: House price index, from ECB.

Spread: Nominal lending rate – Treasury bill rate, IFS database.

**Spain**

NPL: Total doubtful assets. Banco de España.

Unemployment: Unemployment rate from IFS database.

Real lending rate: Nom. lending rate – Inflation

Nom. lending rate: Lending rate, IFS database.

Inflation: (CPI index (t) - CPI index (t-4))/CPI index (t-4), CPI index from IFS database.

Debt: Total household debt outstanding, Banco de España.

Income: Household disposable income from National Annual Accounts, interpolated using growth rate of GNI (Eurostat).

Real wealth: Housing wealth of households and NPISH[22], Banco de España (series code BESI_01.05.ES.33).

Financial wealth: Gross financial wealth = Financial assets, Banco de España (series code BESI_01.05.ES.).

HH: Number of households, Eurostat (quarterly frequency obtained by linear interpolation of annual data).

Own: Ratio of owner occupied houses, from "Housing Statistics in the European Union 2003" National Agency for enterprises and housing.

HP: House price index, ECB.

Spread: Nominal lending rate – Treasury bill rate, IFS database.

**Finland**

NPL: Non-performing assets related to households[23], Finlands Bank.

Unemployment: Unemployment rate from IFS database.

Real lending rate: Nom. lending rate – Inflation.

Nom. lending rate: Lending rate, IFS database.

Inflation: (CPI index (t) - CPI index (t-4))/CPI index (t-4), CPI index from IFS database.

Debt: Stock of total banks' lending to households, Finlands Bank.

Income: Disposable personal income, OECD database (series code OEO.Q.FIN.YDH).

Real wealth: derived from the number of existing dwellings (from European Mortgage Federation) and the house market price (the initial house price is derived from "Housing Statistics in the European Union 2003". It was interpolated at quarterly frequency obtained using residential property prices from the National Statistical Institute).

Financial wealth: Gross financial wealth = Financial assets from Finlands Bank.

HH: Number of households, Eurostat (quarterly frequency obtained by linear interpolation of annual data).

Own: Ratio of owner occupied houses, from "Housing Statistics in the European Union 2003" National Agency for enterprises and housing.

HP: House price index, ECB.

Spread: Nominal lending rate – Treasury bill rate, IFS database.

[22] Non-profit institutions serving households.

[23] Household sector includes individual enterprises with is less than 2 employees and NPISH.

**France**

NPL: Gross doubtful debt of households, Banque de France (series code MH.Q.ME.CREDIT.3.R.1D.DL.X.T.X.B.X).

Unemployment: Unemployment rate from OECD database.

Real lending rate: Nom. lending rate – Inflation.

Nom. lending rate: Lending rate, IFS database.

Inflation: (CPI index (t) - CPI index (t-4))/CPI index (t-4), CPI index from IFS database.

Debt: Total household debt outstanding, Banque de France (series code MH.Q.ME.CREDIT.3.R.1D.TO.T.T.X.B.X).

Income: Disposable personal income, OECD database (series code OEO.Q.FRA.YDH).

Real wealth: Non-financial assets of household from OECD interpolated using the quarterly variation of residential property prices (ECB).

Financial wealth: Financial assets from OECD interpolated using the quarterly variation of stock prices (France CAC 40 index) + Debt.

HH: Number of households, Eurostat (quarterly frequency obtained by linear interpolation of annual data).

Own: Ratio of owner occupied houses, from "Housing Statistics in the European Union 2003" National Agency for enterprises and housing.

HP: House price index, ECB.

Spread: Nominal lending rate – Treasury bill rate, IFS database.

**Ireland**

NPL: Non-performing loans on residential mortgages, Central Bank of Ireland and own estimations.

Unemployment: Unemployment rate from OECD database.

Real lending rate: Nom. lending rate – Inflation.

Nom. lending rate: Lending rate, IFS database.

Inflation: (CPI index (t) - CPI index (t-4))/CPI index (t-4), CPI index from IFS database.

Debt: Residential mortgages outstanding, Central Bank of Ireland.

Income: Disposable personal income, OECD database (series code OEO.Q.IRE.YDH).

Real wealth: Derived from the number of existing dwelling (from European Mortgage Federation) and the house market price. The initial house price is derived from the Annual Report 2002 of the Central Bank of Ireland, Annex C and derived on quarterly frequency using the residential property price index (ECB).

Financial wealth: Estimated from total financial assets in Ireland assuming that the share held by households equals the relative share of Belgian households + Debt.

HH: Number of households, Eurostat (quarterly frequency obtained by linear interpolation of annual data).

Own: Ratio of owner occupied houses, from “Housing Statistics in the European Union 2003” National Agency for enterprises and housing.

HP: House price index, ECB.

Spread: Nominal lending rate – Treasury bill rate, IFS database.

**Italy**

NPL: Bad debts of households, Banca d’Italia, Supplements to the Statistical Bulletin, Monetary and Financial indicators, table TDUE0120.

Unemployment: Unemployment rate from IFS database.

Real lending rate: Nom. lending rate – Inflation.

Nom. lending rate: Lending rate, IFS database.

Inflation: (CPI index (t) - CPI index (t-4))/CPI index (t-4), CPI index from IFS database.

Debt: Total household debt outstanding, Banca d’Italia, Supplements to the Statistical Bulletin, Monetary and Financial indicators, table TDME0070.

Income: Disposable personal income, OECD (series code OEO.Q.ITA.YDH).

Real wealth: Non-financial assets of household from OECD interpolated using the quarterly variation of residential property prices (ECB).

Financial wealth: Net financial wealth, from the Annual Financial Accounts of the Euro Area (ECB) interpolated using the quarterly variation of stock prices (MIB 30 index) + Debt.

HH: Number of households, Eurostat (quarterly frequency obtained by linear interpolation of annual data).

Own: Ratio of owner occupied houses, from “Housing Statistics in the European Union 2003” National Agency for enterprises and housing.

HP: House price index, ECB.

Spread: Nominal lending rate – Treasury bill rate, IFS database.

**Portugal**

NPL: Non-performing loans to private individuals, Banco de Portugal.

Unemployment: Unemployment rate from IFS database.

Real lending rate: Nom. lending rate – Inflation.

Nom. lending rate: Lending rate, IFS database.

Inflation: (CPI index (t) - CPI index (t-4))/CPI index (t-4), CPI index from IFS database.

Debt: Total outstanding debt to private individuals, Banco de Portugal.

Income: Household disposable income from National Annual Accounts interpolated using the quarterly variation of Gross National Income (Eurostat).

Real wealth: Derived from the number of existing dwellings (from European Mortgage Federation) and the house market price per square meter (the initial house price is derived from Banco de Portugal, and was grown on a quarterly basis using the residential properties price index (Banco de Portugal).

Financial wealth: Net financial wealth, of the household sector from Banco de Portugal interpolated using the quarterly variation of stock prices (PSI20 index) + Debt.

HH: Number of households, Eurostat (quarterly frequency obtained by linear interpolation of annual data).

Own: Ratio of owner occupied houses, from “Housing Statistics in the European Union 2003” National Agency for enterprises and housing.

HP: House price index, ECB.

Spread: Nominal lending rate – Treasury bill rate, IFS database.