Private Saving Rates and Macroeconomic Uncertainty: Evidence from Spanish Regional Data

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September 2012

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October, 2012

Abstract

The onset of the Great Recession has been followed by increasing saving rates, which may reflect precautionary behaviour of households. In spite of a broad agreement on the theoretical implications of uncertainty on saving rates, empirical work has not yet reached a consensus on which is the most reliable measure of uncertainty. In this paper we empirically test the precautionary saving theory and explore different measures of macroeconomic uncertainty, using Spanish regional data for the period 1980-2007. Our results suggest that part of the large increase in saving rates that took place in the aftermath of the recession is related to a precautionary motive and that increased uncertainty causes greater savings rates. Moreover, our results also suggest that, in the case of the Spanish economy, the unemployment rate is a relevant variable to measure future income uncertainty.

JEL Codes: E21, R20

Keywords: Precautionary savings, uncertainty, regions, Spain

[▽] Authors acknowledge comments from other members of the GAME research group, participants at the *7th Annual International Symposium on Economic Theory , Policy and Applications,* Athens, July 2012, and Kevin Albertson. Remaining errors are our sole responsibility. We acknowledge financial support from Xunta de Galicia, through grant 10SEC242003PR.

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1. Introduction

The magnitude of the current recession in Europe is overwhelming. Unemployment has soared to very high levels, GDP growth has remained low or negative for almost 5 years now, and the sovereign debt crisis has swept several governments and forced the EU authorities to apply different rescue programs to governments and banks across Europe. One of the main consequences of this series of events at a macroeconomic level is the increased level of uncertainty in the markets, which is reflected for instance, in greater risk premium in financial markets for questioned countries, or a continuous revision of economic forecasts, such as those by IMF, OECD or the European Commission (see Mody *et al.*, 2012).

Economic models have stressed the influence of uncertainty on both micro and macroeconomic performance, especially concerning consumption and saving. Since the works of Leland (1968) and Dréze and Modigliani (1972), it is now conventional wisdom that under relatively mild assumptions on the intertemporal utility function of consumers (namely that the marginal utility is convex), increased uncertainty about future income lowers current consumption and forces an increased "precautionary saving". This hypothesis has been extensively tested in literature and there is ample evidence in favour of its existence (see for instance, Hahm, 1999, Hahm and Steigerwald, 1999, Lyhagen, 2001, Menegatti, 2007, 2010 or Mody *et al*, 2012 for examples that use macroeconomic datasets for different sets of countries or regions, or Guiso *et al*, 1992, Dynan, 1993, Lusardi, 1998 or Guarilia and Kim, 2003 for evidence with micro data). However, there is no consensus on which is the most reliable measure of uncertainty. The standard theoretical models of consumption show that the optimal intertemporal path is described by an Euler equation that relates expected future consumption growth with the conditional variance of consumption growth rates (see, for instance, Attanassio, 1999). However, this relation cannot be estimated directly since, as noted by Carroll (1992) the conditional variance can be an endogenous variable depending on wealth accumulation. This problem has been solved in literature by substituting this variable by measures of future income growth uncertainty (see Hahm, 1999, Menegatti, 2007, 2010. Mody *et al*, 2012). Additionally, the relation is usually extended by the inclusion of income growth, to capture the existence of liquidity constraints or consumer myopia, following the "rule-of-thumb" of consuming their current income. However, other strands of literature argue that the best way to measure uncertainty about future income growth is through unemployment rate, since it directly measures the probability of being employed in the future and, therefore, of receiving labour income (see Dynarski and Sheffrin, 1987, Malley and Moutos, 1996 Cuadro-Sáez, 2011 or Sastre and Fernández-Sánchez, 2011 for a discussion). Mody *et al* (2012) include both type of measures (they proxy future income expectations by leads of income volatility estimated from a GARCH model), and find that both are highly significant when explaining the evolution of saving rates in a set of 27 of the world's advanced economies.

Another strand of literature has focused on the determinants of saving rates. Carroll and Summers (1987), Graham (1987, 1989), Kessler *et al* (1993), Cook (1995), Edwards (1996), Kazarosian (1997), Loayza *et al* (2000), Bandiera *et* al (2000), Bosworth and Chodorow-Reich (2007), Horioka and Terada (2010) or Mody *et al* (2012) are a few examples of papers that have tried to identify the main determinants of savings. The general conclusion is that growth variables, income measures and demographics play an important role in the explanation of saving rates. Moreover, many of these studies include some measures of uncertainty (as for instance the inflation rate), concluding that in general it is highly significant in the empirical models.

This paper adds to the current literature on the determinants of savings rates providing new econometric evidence of the relation between saving and uncertainty, pooling information from the 17 Spanish regions for the period 1980-2007. Specifically, our contribution is twofold. First, our paper makes us of regional data to exploit the geographical variability in saving rates, and it is the first attempt (to the authors' knowledge) to analyse the relation between uncertainty and saving at the regional level in Spain.[1] Second, we do not restrict our attention solely to the saving-uncertainty relation, and contrary to Menegatti (2007) or Marchante *et al* (2001), we include in our empirical model both uncertainty measures and macroeconomic control variables in order to isolate the effect of uncertainty on current saving behaviour.

The analysis of saving rates is relevant at a macroeconomic level for two reasons. First, the Solow growth model states that saving does not affect long run growth: an increase in the saving rate of the economy would only affect the adjustment path towards a new steady state. Therefore, following this view, saving would be unimportant to explain growth. However, literature on endogenous growth has stressed the role played by savings on capital accumulation and, therefore, on long run growth rates (Romer, 1986, Rebelo, 1991). In the medium and short run, saving is important as a determinant of investment. Even in economies with limited capital, mobility and higher domestic savings will induce higher domestic investment and, therefore, the growth rate will also increase. As Edwards (1996) remarks, there is ample empirical evidence indicating that, on average and over long periods of time, changes in capital accumulation respond mostly to changes in domestic savings. This justifies the interest on the determinants of saving rates.

[1] Marchante *et al* (2001) analyze determinants of saving rates at a regional level in Spain for the period 1986-1994, but they do not explicitly include any uncertainty measure in their econometric model.

The current recession is characterised by higher saving rates. We argue that the increased uncertainty has led to households to increase the precautionary saving, and therefore to lower consumption expenditures with negative effects on economic activity rates. However, in the Spanish case, we do not expect this current increase in savings to be reflected in increased future consumption. This is due to the very high level of financial leverage of households, as well as the high and increasing degree of future income uncertainty measured by unemployment rate. As Cuadro-Sáez (2011) states, the very high level of household indebtedness is now being perceived as non-sustainable and is forcing families to increase saving to reduce their debt burden. Moreover, this process will take years to be completed. On these grounds, the increase in saving will generate a fall in consumption whereas neither future consumption nor investment will grow. Thus, aggregate demand will keep weak during the forthcoming years. Policymakers should be aware of issues before any tax or labour market reforms**.** As long as the unemployment rate remains high, income uncertainty will also remain high and saving rates will continue increasing. So, an unemployment reduction through a consumption stimulus may be a good starting point.

In this context, the paper is structured as follows: Section 2 provides information on the evolution of saving rates in Spain and other European countries through the last decades; Section 3 summarises our theoretical framework of precautionary saving; Section 4 provides the econometric results; and Section 5 concludes.

2.- The saving rate in Spain: a comparison with other European countries

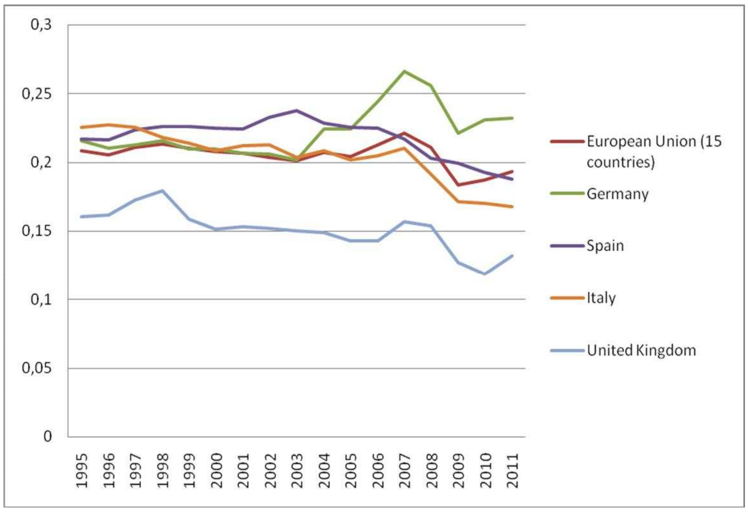
Saving rates have varied considerably in Europe through the last 15 years. Figure 1 provides some initial information. While the EU15 average has fluctuated around a value of 20% since 1995, the variability among core EU countries is very high.[2] Thus, in Germany the saving rate was roughly constant from 1995 until 2004, increasing to 26% in 2007. Since then, the rate has lowered somewhat to its current 23%. Spain, on the contrary, showed an average total saving rate higher than the EU15 until 2007, when it fell to 18%. The UK is an outlier in European terms, since its rate has been persistently lower than the average of the EU15 and other main core countries.

The total saving rate includes public saving and is therefore affected by changes in government budget deficits, which were reduced in the 90's due to the Maastricht convergence criteria to enter the European Monetary Union. Despite this, they increased sharply with the onset of the recession in 2007, after strong expansionary fiscal policies followed by most Western governments. Therefore, we focus our attention on private

[2] The data for this section has been taken from the European Commission dataset AMECO. The saving rate is defined as total saving over total national disposable income.

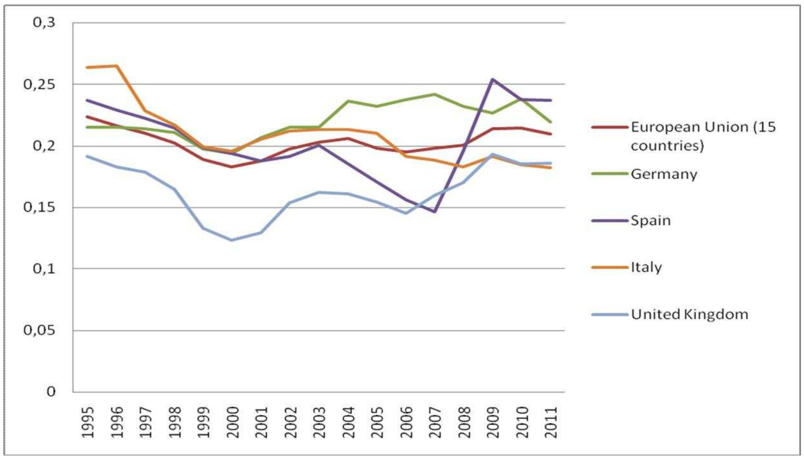
saving rates, which are depicted in Figure 2. Here we observe that the German saving rate has been the highest since 2003, whereas the Spanish rate has been experiencing reductions from 23, 6% in 1995 to a minimum of 14,6% in 2007. The UK, although exhibiting lower saving rates than the rest of the analysed countries, shows now a more ‘European’ pattern, especially after the outbreak of the recession. Interestingly, Italy shows a similar saving pattern to Spain (high rates in the 90’s and low rates before the beginning of the recession) even though it has not experienced an increase as high as the Spanish one. Overall, this analysis suggests that the recession has been followed by an increase in the private saving rate in many countries, especially in Spain, where in three years it reached a value higher than that of the 90’s. On the other hand, Figures 1 and 2 suggest that in many countries total saving rates were high due to the relatively good performance of public saving, which in many cases (once again Spain is a good example) more than outweighed the behaviour of the private sector.

Figure 1. Gross saving rate. Total



Source: AMECO database, European Commission

Figure 2. Gross saving rate. Private



Source: AMECO database, European Commission

Table 1 provides some basic information on private saving rates in some EU core countries for the period 1995-2011. While almost every country in the sample (except the UK) has showed an average saving rate close to 20%, the variability through time is much greater in some countries than in others. For instance, Germany has shown a relatively stable saving rate with a standard deviation of 0.015, while Spain and Italy with average saving rates of 20% show a standard deviation of 0.03 and 0.02 respectively, i.e., almost twice as much as Germany. Moreover, the difference between the maximum and the minimum value in the time series is the highest in Spain (10.7 points of variation) and the lowest in France (2 points of variation). This table indicates an interesting pattern which deserves future research. Continental core EU countries tend to exhibit higher and stable saving rates, whereas Southern Mediterranean countries tend to exhibit lower (on average) and more volatile saving rates. The UK remains as an outlier, but its pattern resembles the Spanish, with low and volatile saving rates as compared to other European countries. This may be because both countries experienced a real estate bubble in the last decade, which led to a very high level of household financial leverage and low saving rates.

Table 1

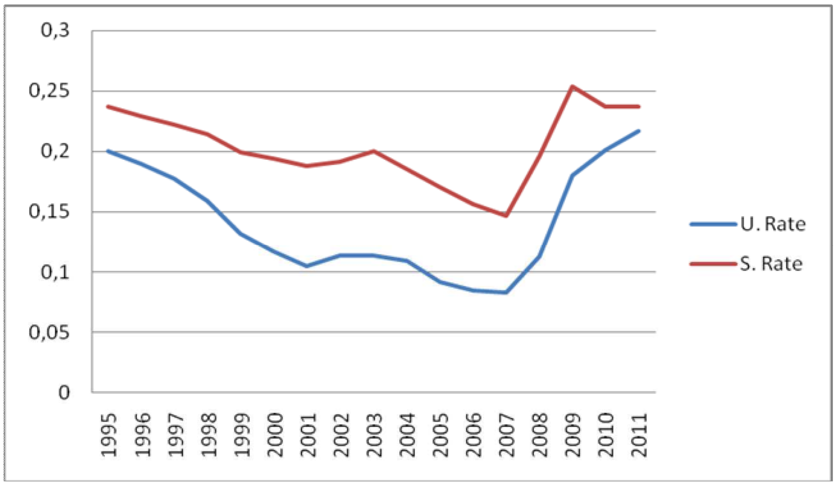
Saving rates: descriptive statistics. Selected countries

	EU15	*FRANCE*	*GERMANY*	*ITALY*	*SPAIN*	*UK*
Mean	0,20	0,19	0,22	0,21	0,20	0,16
Median	0,20	0,19	0,22	0,21	0,20	0,16
Maximum	0,22	0,21	0,24	0,26	0,25	0,19
Minimum	0,18	0,18	0,19	0,18	0,15	0,12
Max-Min	0,04	0,02	0,05	0,08	0,11	0,07
Std. Dev.	0,01	0,01	0,01	0,02	0,03	0,02

Source: Authors own calculation from AMECO data, European Commission.

The increase in the Spanish saving rate has coincided with an unprecedented rise in the unemployment rate, which soared from 8% in 2007 to almost 23% by 2011. As discussed earlier, various strands of the existing literature have related the evolution of the unemployment rate to precautionary saving, i.e., an increase in the saving rate of households to protect themselves from the possibility of lower future labour income (Dynarski and Sheffrin, 1987 or Malley and Moutos, 1996). Before analysing this potential relation through econometric techniques, in this section we provide incidental evidence on the evolution of the unemployment and saving rates. Figure 3 depicts both variables for the Spanish economy since 1995. The downward trend in the unemployment rate, which started in 1994, after peaking to 23%, was accompanied by a similar path in the saving rate. Also, the turning points in the unemployment rate evolution were followed by similar changes in the saving rate. For instance, at the beginning of the last decade of the current century, the unemployment rate slowed its decrease, showing a slight increase between 2001 and 2002. The saving rate followed, increasing from 18.7% in 2001 to 20% in 2003. However, as the unemployment rate resumed its downward path, the saving rate also lowered, reaching a minimum of 14.6& in 2007, precisely when the unemployment rate also reached its minimum value since the 80's. 2007 is a turning point for both variables such that by 2011 both exhibit their maxima during the last decades. Therefore, it is clear that a positive relation between saving patterns of families and the status of the labour market exists. Moreover, this relation is the strongest among the core EU countries, suggesting that the positive relation between the unemployment rate and the saving rate is increasing with the level and variability of the unemployment rate. Table 2 presents the correlation coefficient between both variables in the same countries listed in Table 1, for the period 1995-2011. Note that Spain exhibits the largest correlation coefficient (0.93), followed by the UK (0.77) and Italy (0.68). Germany and France present much lower coefficients (0.17 and 0.08 respectively) which suggests that in these countries saving patterns are not affected by the uncertainty caused by the unemployment rate, most likely due to the stability of the unemployment rate through time. Once again, different patterns of savings emerge among the EU countries, which justify the need to study separately each national experience.

Figure 3. Saving rate and unemployment rate. Spain



Source: AMECO database, European Commission

Table 2

Correlation coefficient between saving rates and the unemployment rate

EU15	0,76
SPAIN	0,93
GERMANY	0,17
FRANCE	0,08
ITALY	0,68
UK	0,77

Source: Authors own calculation from AMECO data, European Commission

In sum, this section provides evidence that from the onset of the current recession savings rates has increased in general, most likely as a response to the increased uncertainty caused by the worsening of the labour market prospects. During the expansion of the last decade, saving rates were low, especially in countries where financial leverage increased more due to housing bubbles or excessive credit growth. The end of the boom collapsed the financial system and cut credit, which added to the fall in consumption and investment. The result is higher unemployment, which is curtailing consumption even more, due to the precautionary increase in savings. The next section will provide a general theoretical framework to analyse more precisely the effect of unemployment on saving.

3. A simple model of precautionary savings

As pointed out previously, the implication of uncertainty for country-level precautionary saving has received less attention than its relevance at individual and household levels.

The purpose of this section is to provide a theoretical framework for the econometric analysis developed at the macroeconomic level for the Spanish economy in Section 4. In particular, we try to highlight how uncertainty is expected to affect consumption and savings decisions and the way uncertainty can be measured.

There are many reasons to save: bequest motives, planning for your retirement, buying something or investing. However, the most important reason (namely in an uncertain environment) is being prepared for contingencies. In other words, consumers are ‘prudent’ in Kimball’s (1990) sense. This precautionary saving motive is consistent with a version of the life cycle and permanent income hypothesis in which consumers face important income uncertainty (Carrol, 1992, 1997).

Following the standard models commonly used in the precautionary savings literature, we consider a consumer who has to decide how much of their current income to consume in the present and how much to save for the future.

The intertemporal optimization problem solved by the consumer can be expressed as follows. The consumer maximizes the expected present value of their lifetime utility:

$$Máx\sum_{t=0}^{\infty}\frac{1}{(1+\rho)^{t}}E_{t}[U(C_{t})]\ ;\quad U'(\cdot) > 0,\ U''(\cdot) < 0 \tag{1}$$

subject to the usual budget constraint:

$$\sum_{t=0}^{\infty}\frac{1}{(1+r)^{t}}C_{t} = A_{0} + \sum_{t=0}^{\infty}\frac{1}{(1+r)^{t}}Y_{t} \tag{2}$$

where E is the expectations operator, $U(\cdot)$ is the instantaneous utility function, ρ is the subjective discount rate, C_t is consumption in period t, A_0 is the initial wealth, r is the (constant) interest rate[3] and Y_t is income in period t.

Given the non-satiation and risk aversion assumptions on the utility function, different authors (see *inter* alia Leland, 1968; Dréze and Modigliani, 1972) show that income uncertainty increases saving. That is, there is a precautionary saving if marginal utility is convex $(U'''(\cdot)>0)$.

If a precautionary saving motive exists, an increase in income uncertainty increases current saving, decreasing current consumption and increasing expected future consumption. In this proposition, two different relations can be analysed using two different tests (Hahm, 1999; Menegatti, 2007, 2010). On one hand, we can test whether there is an increasing relation between income uncertainty and expected future consumption. On the other hand, we can analyse the effect of income uncertainty on the saving rate. These tests are different and, therefore, the results should be interpreted differently.

Since income is either consumed or saved, it is clear that the dynamics of both variables are related. However, according to Menegatti (2010), “one is not simply the mirror of the other”. In the first case, *consumption growth* from period t to period $t+1$ is considered (involving consumption decisions in both periods, subject to the degree of uncertainty in both periods), while the second considers, for t, the *level of the saving rate*, depending on the degree of uncertainty in that period.

In order to obtain a formulation of consumption dynamics that allows us to run the first test, we assume that the instantaneous utility function takes the form of a Constant Relative Risk Aversion (CRRA) utility function $(U(C_t)=C_t^{(1-\theta)}/1-\theta$, where θ is the coefficient of relative risk aversion) and consumption shocks are lognormally distributed. With these assumptions, it can be shown (Hahm, 1999; Carroll, 1992, 1997) that the optimal consumption will grow according to,

[3] We are interested in analysing the effects of income uncertainty caused by uncertainty about future labour income but we can also consider, as Mody et al 2012, the investment risk from variations in saving return.

$$E_t(\Delta \ln C_{t+1}) = \frac{r-\rho}{\theta} + \frac{1}{2}\theta[\Delta \ln C_{t+1} - E_t(\Delta \ln C_{t+1})]^2 . \quad (3)$$

where the term $[\Delta \ln C_{t+1} - E_t(\Delta \ln C_{t+1})]^2$ is the conditional variance of consumption growth. By multiplying this term by $\theta/2$, we have the precautionary premium related to income uncertainty.

However, given that the conditional variance of consumption growth rates can be an endogenous variable depending on accumulated wealth (Carroll, 1992), equation (3) cannot be directly estimated. In order to carry out empirical tests on precautionary saving, at least two considerations should be taken into account. As proposed by Hahm (1999), the conditional variance of consumption growth rates should be substituted by a measure of uncertainty on future income growth. Moreover, when explaining consumption growth, income growth should be introduced as a control variable for the following reasons: the existence of liquidity constraints and/or a large fraction of individuals consuming all of their current income, which are a result of myopic behaviour (Campbell and Mankiw, 1989).

An increase in income uncertainty is expected to stimulate saving rates since households protect themselves against financial adversities.[4] The precautionary saving theory states that a larger uncertainty implies a larger saving and if uncertainty is constant, it also implies future consumption growth. However, if the degree of uncertainty varies over time, a greater uncertainty in period *t* increases saving rate, but does not increase consumption in period *t+1*. Under this circumstance, an equation considering the relation between uncertainty and consumption growth cannot test the precautionary saving theory and a "*saving rate*" test is necessary. So, as previously mentioned, we also directly test the saving theory by analysing the effect of uncertainty on the saving rate.

Another reason why the conclusions on the precautionary saving theory should be tested through the relation between uncertainty and saving rate rather than through the relation between uncertainty and consumption growth can be found in Carrol (1992), where consumers are assumed to be impatient. In this case, consumers try to quickly achieve a *buffer stock* and then adjust consumption growth to income growth, implying no relation between uncertainty and consumption growth.

Taking into account these arguments, we can conclude that under a low and stable degree of uncertainty, individuals choose optimal consumption and then they save the rest of their income. In contrast, under a high and variable degree of uncertainty, individuals

[4] Therefore, precautionary saving motives provide an explanation for the quiet counter-intuitive consumption-saving behaviour, that is, why consumers do not reduce saving or increase borrowing during recessions.

decide how much they need to save and then they consume the rest of their income. This different approach on consumption-saving decisions influences the effects of uncertainty on the dynamics of consumption and the saving rate, as well as the way precautionary saving theory must be empirically tested.

Following the theory described, the estimated equations in Section 4 include measures of uncertainty on future income growth (that is, on income dynamics), per capita income growth rate and a number of control variables commonly used in the precautionary saving empirical literature, such as per capita disposable income (to capture the income level effects on saving), the inflation rate, financial and non-financial wealth (a negative correlation between wealth and saving rate is expected), socio-demographic factors (proxied by female activity rate), and domestic private credit (to introduce restricted access to credit).

The uncertainty on income growth will be proxied by two different variables. The first one is the conditional variance of expected future income, obtained by estimating the expected income growth by ARMA models (Menegatti, 2007, 2010, see below).

The other variable capturing uncertainty on future income is the unemployment rate. Since most people obtain their income from labour, the main cause of loss of future income is loss of employment. Therefore, the unemployment rate directly measures the probability of receiving or not receiving labour income in the future. An increase in the unemployment rate should increase saving rates by increasing labour income risk and by reducing expected income (Mody *et al* 2012).

4.- Empirical evidence

4.1. Data

In this paper we use regional data from the 17 Spanish regions (*Comunidades Autónomas*), at NUTSII level, for the period between 1980-2007. The use of regional data to address saving patterns can be justified on the grounds that regional variability complements the relatively short time dimension of existing datasets, in order to asses long run relations between the involved variables. Some of the control variables we will use in the econometric exercise have a rather short time dimension, and therefore the use of regional data can increase the quality of the estimations. On the other hand, as Marchante *et al*. (2001) remark the average propensity to save is usually neither uniform over time or across regions, which implies that the national saving rate is in every period a weighted average of different regional saving rates. Taking into account this fact will help analyse the effect of uncertainty on saving (through its regional variability) and identify other relevant determinants of saving.

The main data source is the BD-MORES dataset, provided by the Ministry of Economy and the University of Valencia, which takes the form of regional accounting type data. From this dataset we have figures on regional gross disposable income and consumption expenditures (and therefore, saving), all in real terms. We also take the regional GDP at constant 2000 market prices and the total regional population to measure *per capita* variables. For the remaining variables of our model the data sources are different, being this information summarised in Table 3.

The reason to restrict ourselves to the period ending in 2007 is the lack of new information by the BD-MORES dataset, which is regularly updated. We have tried to extend the information up to 2010 through the combination of the growth rates of key variables from the Regional Accounting data provided by the INE to the BD-MORES data, but there is no available data from the Regional Accounting on household income, and therefore we cannot compute disposable income or saving.

Table 3. Variables in the econometric model

Variable	Definition	Source
DLCPC	First difference of the log of per capita consumption	BDMORES dataset
S	Saving rate, defined as the ratio of gross private saving to disposable income	BDMORES dataset
UNCERTAINTY	Conditional variance of growth rates of regional aggregate income	Author's elaboration, based on GDP series from the BDMORES dataset
URATE	Unemployment rate	Labour Force Survey, INE
INFLATION	First difference of the log of CPI	INE
1/RBD	Inverse of the per capita real disposable income	BDMORES dataset
CRED_RBD	ratio of total credit to the private sector over gross disposable income	Bank of Spain, Boletín Estadístico, and BDMORES dataset
NFWEALTH	Ratio of wealth at the beginning of the period over per capita disposable income. Wealth is proxied by net stock of private capital stock	BDMORES dataset
FEMALE_ACT	Female activity rate, defined as the ratio of female labour force over female working age population	Labour Force Survey, INE

4.2. Econometric model

Since regional data is used to assess the impact of uncertainty on saving and consumption, we build a panel of 17 regions for the period 1980-2007 and estimate different models to explain saving rates as a function of a set of potential explanatory variables suggested by the most relevant literature.[5] As discussed in Section 3, Menegatti (2010) argues that the effect of uncertainty on consumption decisions derived from the standard models can be empirically analysed by using two partially different tests related to consumption growth and the saving rate. Therefore, we provide two sets of

[5] Since we are considering the whole set of Spanish regions, fixed effects models are preferred to random effects models. Moreover, Hausman tests point to the validity of the fixed effects approach.

estimations: one for the consumption growth model and another for the saving rate equation.

The initially estimated equations are given by:

$$\Delta c_{it} = \alpha_{i,t} + \beta\sigma_{i,t} + \gamma\Delta y_{i,t} + \varepsilon_{i,t} \qquad (4)$$

$$s_{i,t} = \lambda_i + \gamma\sigma_{i,t} + \phi\Delta y_{i,t} + v_{i,t} \qquad (5)$$

where $c_{i,t}$ is the log of consumption in region *i*, s_{it} is the saving rate in region *i* (as defined in Table 3), $\sigma_{i,t}$ is the measure of uncertainty in region *i* and $\Delta y_{i,t}$ is the first difference of the log of per capita GDP (all variables measured in real terms). We thus assume that the errors terms $\varepsilon_{i,t}$ and $v_{i,t}$ follow a fixed effects model. The coefficients α_i and λ_i represent time-invariant regional effects. Therefore, we assume that regions show a similar behaviour regarding coefficients for the different variables (slope coefficients) except for the intercept, which varies across regions (Baltagi, 2008).

Before presenting our estimations, some econometric considerations should be made. Firstly, Loayza *et al* (2000) suggest that the estimation of consumption or saving models should take into account the inertia in these variables, which is especially relevant when using annual data. This leads to a dynamic specification of the models above, adding lags on the dependent variable. This, in turn, introduces a second econometric issue to deal with. Let us consider the following illustrative model with homogenous slopes and differing constants to clarify the issues arising from the estimation of a dynamic version of a model as in equations (4) or (5):[6]

$$y_{i,t} = \alpha_i + \beta x_{i,t} + \gamma y_{i,t-1} + u_{i,t}, \quad u_{i,t} \sim iid\ N(0,\sigma^2)$$

where the independence assumption for the error terms refers to time and cross-section, i.e., $E(u_{i,t}, u_{j,t-s})=0$ for $i \neq j$ or $s \neq 0$. The fixed effect estimator —the most common for dynamic panels— is consistent in dynamic panels with constant slopes as $T \to \infty$ for fixed *N*.

It has been clearly shown in the literature that when *T* is small relative to *N* the OLS estimation is inconsistent (for example, when $N \to \infty$ for a fixed *T* gives rise to the Nickell bias). In this case, the standard approach is to use a General Method of Moments (GMM) estimator, such as the Arellano and Bond (1991) DPD or the Blundell and Bond (1998) BB estimators. In these estimators, the data is first differenced in order to eliminate the fixed effects. It is also well known that the GMM estimator is efficient for large cross sections with relatively few time periods (Baltagi, 2008).

[6] Here we follow Smith and Fuertes (2010).

Note that for our sample the time dimension is clearly greater than the cross-section dimension: 21 time observations × 17 regions. In other words, *N/T* is smaller than 1, so that we can confidently assume that *T* grows sufficiently fast relative to *N*. In this light, our estimation results are not likely to be affected by the Nickell bias or other inconsistencies, and we are thus justified to proceed with the standard one-way fixed effects estimation. Nevertheless, we have also estimated the models by the Generalised Method of Moments (Arellano and Bond estimator). Overall, results between both models are similar, which reinforces our prior as regards the absence of the Nickell bias in our econometric model.

4.2. Econometric results

Tables 4 and 5 summarise the results of the estimation of the consumption growth and the saving rate models as previously discussed. For each model we have estimated five different specifications, presented in Tables 4 and 5 under the columns (1) to (5). Specification (1) is the estimated version of the theoretical models discussed in Section 3, where consumption growth and the saving rate are regressed on uncertainty (measured as the conditional variance of expected future income) and the growth rate of per capita income. As mentioned above, the dynamic version of the models were also estimated by GMM (columns (2′) to (5′) in each table). Overall, the results from both models are roughly similar.

The consumption model is in line with previous results (Hahm and Steigerwald, 1999, Menegatti, 2007, 2010) and shows that while uncertainty does not influence consumption growth, the current growth of per capita income is highly significant. The lack of significance for the uncertainty measure can be interpreted as an indication that the utility function is not in fact a CRRA nor that consumers are impatient and choose a consumption path completely determined by income growth. The saving model, on the contrary, shows the expected signs and both coefficients are significant, these results providing strong support for the precautionary saving theory. However, these models have a low value of the Durbin-Watson (DW) statistic, which is a clear sign of serial correlation. Therefore, we added the first lag of the dependent variable to take into account inertia in the consumption and saving decisions and re-estimate the models. The results are reported in columns (2) and (2′) of tables 4 and 5. Overall the results on the significance and impact of uncertainty and income growth do not change. Interestingly, the value of the coefficient of the uncertainty variable in the saving equation falls from 0.12 to 0.04, indicating a much more reduced impact once serial correlation is taken into account.

Given this preliminary evidence, we now turn to alternative specifications of the models. We start by substituting the uncertainty measure by the unemployment rate. As we discussed in Section 3, this variable proxies the probability of being employed in the future and, therefore, of receiving labour income. A greater unemployment rate should decrease consumption growth and increase the saving rate. Moreover, if the unemployment rate is persistently higher, the level of uncertainty will be sustained through time, and will cause households to increase precautionary savings. The results of this specification are shown in columns (3) and (3') of tables 4 and 5.[7]

Results of this estimation are discouraging, since in both models the unemployment rate is insignificant, which would suggest that the state of the labour market does not have any influence on consumption and saving behaviour of Spanish households. The income growth effect remains positive and significant in the consumption equation and negative and significant in the saving rate equation. Given these results, we then combine both measures, in order to control for potential different effects depending on the source of the uncertainty. The results of this estimation are reported in columns (4) and (4') and show, for both models that, once again, only the income growth effect remains significant.

The apparently discouraging results led us to extend the original model in order to control for additional determinants of consumption growth and saving rates. Among the reviewed literature there seems to exist a consensus on the type of control variables to include in this type of models (See Loyaza *at al.*, 2000). Therefore, the inflation rate is usually included in order to control for macroeconomic stability. Higher inflation rates imply worse forecasts of future income and asset returns and, therefore, should reduce consumption and increase saving rates. Additionally, we control the effect of income level in our dependent variables and the possibly nonlinear relationship by including the inverse of per capita disposable income level, following Modigliani (1993) and Marchante *et al.* (2001). We also control for liquidity constraints by adding the ratio of regional aggregate credit to the private sector to gross disposable income, following Japelli and Pagano (1994). An increase in the 'credit rate' to the private sector should result in higher consumption growth and lower saving rates since access to credit is easier. We also include measures of non-financial wealth by using the ratio of per capita real wealth at the beginning of the period and per capita gross disposable income. Following Andrés *et al* (1990) or Argimón *et al.* (1993) we proxy wealth data by the net stock of private capital stock, including residential real estate. Finally, we also control for socio-demographic changes at the regional level by including the female activity rate. We tried to use data on financial wealth at the regional level by including saving deposits over total deposits and several related variables, but none of them resulted significant in the empirical models. We also tried to include other demographic variables, such as the

[7] In the remainder of the estimations we maintain the first lag of the dependent variable in order to tackle the serial correlation problems detected in the levels equations.

old age dependency ratio or the child dependency ratio, but regional data is only available since 1998, which left us with a rather small sample and many variables became insignificant.

Results of this extended model are reported in columns (5) and (5') of tables 4 and 5. In general, the results are in line with the theoretical predictions in both models, and provide support for the precautionary saving hypothesis. In the consumption model, the unemployment rate exerts a negative influence on consumption, being this uncertainty measure the only that remains significant. Increased macroeconomic instability (as proxied by the inflation rate) reduces consumption growth, while income levels have a positive effect, validating thus the hypothesis of Modigliani (1993). Non-financial wealth shows a surprising negative and significant coefficient, which is difficult to interpret. Finally, the female activity rate has no effect on consumption growth.

The saving rate model shows that both measures of uncertainty (conditional variance of future income and the unemployment rate) increase saving rates, validating therefore the precautionary savings hypothesis. Furthermore, income growth has the expected negative sign and the inflation rate acts as an important determinant of saving rates. Income levels, credit to income ratios and non-financial wealth have the expected negative effect. Finally, the female activity rate has a positive and significant effect, which can be interpreted as a result of the strategies followed by Spanish families during the last decades: the increasing female participation has implied greater family incomes, which in turn led to a greater propensity to save.

In sum, the evidence found in Tables 4 and 5 suggests the existence of an important precautionary savings motive, which should be taken into account when designing public policies.

Table 4. Consumption growth model

	(1)	(2)	(2')	(3)	(3')	(4)	(4')	(5)	(5')
DLCPC(-1)		0.343**	0.337**	0.363**	0.36**	0.346**	0.298**	0.197**	0.193**
		(7.93)	(7.45)	(8.65)	(7.94)	(7.75)	(6.15)	(4.10)	(3.77)
UNCERTAINTY	-0.017	-0.030	-0.040			-0.032	-0.024	-0.04	-0.043
	(-0.54)	(-1.03)	(-1.30)			(-1.06)	(-0.71)	(-1.56)	(-1.37)
DYPC	0.402**	0.296	0.312	0.287**	0.298**	0.294	0.476	0.494	0.472
	(8.27)	(6.28)**	(6.08)**	(6.37)	(5.91)	(6.23)**	(8.03)**	(8.98)**	(7.96)**
U RATE				0.004	0.006	0.006	0.002	-0.09	-0.136
				(0.198)	(0.03)	(0.268)	(0.11)	(-2.41)**	(-3.00)**
INFLATION								-0.265	-0.357
								(-2.30)**	(-2.89)**
1/RBD								0.766	1.008
								(4.57)**	(5.21)**
CRED_RBD								0.013	0.006
								(1.61)	(0.95)
NFWEALTH								-0.021	-0.028
								(-3.28)**	(-3.66)**
FEMALE ACT								0.025	0.105
								(0.52)	(1.59)
R2	0.17	0.28		0.30		0.28		0.48	
DW	1.48	2.12		2.23		2.13		2.20	
MLL	1003.28	1032.11		1087.04		1032.14		942.65	
Sargan			311.59		311.07		258.76		266.96
(DoF)			288		288		287		273
p-value			0.162		0.167		0.883		0.591

Notes: DLCPC is the growth rate of per capita consumption, uncertainty is the uncertainty measure based on the estimation of the conditional variance of expected future income, DYPC is the growth rate of per capita GDP, URATE is the unemployment rate, INFLATION is the inflation rate, 1/RBD is the inverse of per capital gross disposable income, CRED-RBD is the ratio of total private credit to gross disposable income, NFWEALTH is the ratio of wealth at the beginning of the period over gross disposable income and FEMALE_ACT is the female activity rate. Sargan is the value of the Sargan test of overidentifying restrictions derived by Arellano and Bond (1991); DoF is the number of degrees of freedom of this test. ** indicates significance of 95%. T-ratios in parentheses.

Table 5. Saving rate model

	(1)	(2)	(2')	(3)	(3')	(4)	(4')	(5)	(5')
S(-1)		0.84**	0.843**	0.84**	0.833**	0.83**	0.824**	0.632**	0.629**
		(31.6)	(30.64)	(33.14)	(30.70)	(29.63)	(28.23)	(18.70)	(19.01)
UNCERTAINTY	0.121**	0.04**	0.045			0.03	0.0285	0.061**	0.061**
	(2.73)	(1.96)	(1.90)			(1.57)	(1.14)	(2.56)	(2.66)
DYPC	-0.158**	-0.09**	-0.117	-0.104**	-0.127**	-0.098**	-0.160**	-0.105**	-0.113**
	(-2.29)	(-2.64)	(-3.10)**	(-3.14)	(-3.72)	(-2.62)	(-3.92)	(-2.35)	(-2.61)
U RATE				0.028	0.036**	0.024	0.030	0.101**	0.109**
				(1.69)	(2.11)	(1.32)	(1.63)	(3.31)	(3.70)
INFLATION								0.217**	0.216**
								(2.17)	(2.22)
1/RBD								-0.517**	-0.543**
								(-3.80)	(-4.12)
CRED_RBD								-0.019**	-0.017**
								(-3.60)	(-3.41)
NFWEALTH								-0.02**	-0.02**
								(-3.66)	(-4-09)
FEMALE ACT								0.134**	0.126**
								(2.88)	(2.77)
R2	0.71	0.91		0.92		0.91		0.93	
DW	0.32	2.04		2.06		2.03		1.92	
MLL	858.22	1121.15		1233.69		1122.07		1011.69	
Sargan			378.15		406.6		373.91		343.4
D.o.F.			347		355		346		311
p-value			0.120		0.130		0.144		0.199

Notes: S is the saving rate, uncertainty is the uncertainty measure based on the estimation of the conditional variance of expected future income, DYPC is the growth rate of per capita GDP, URATE is the unemployment rate, INFLATION is the inflation rate, 1/RBD is the inverse of per capital gross disposable income, CRED-RBD is the ratio of total private credit to gross disposable income, NFWEALTH is the ratio of wealth at the beginning of the period over gross disposable income and FEMALE_ACT is the female activity rate. Sargan is the value of the Sargan test of overidentifying restrictions derived by Arellano and Bond (1991); DoF is the number of degrees of freedom of this test.** indicates significance at 95%. T-ratios in parentheses.

5.- Conclusions

This paper provides new empirical evidence regarding consumption and saving behaviour of Spanish households using regional data. The main conclusion of this paper is that at the macroeconomic level, one of the most important determinants of private saving rates is the level of uncertainty about future income, which is in line with previous literature (inter *alia* Edwards, 1996, Loayza *et al.* 2000 or Menegatti, 2007, 2010). This indicates that there exists a precautionary motive for saving, especially when the level of uncertainty is variable and persistent through time. Among the different options for the measure of uncertainty, we highlight that for the Spanish regions the unemployment rate is also a relevant variable.

As Menegatti (2007, 2010), we demonstrate that, while the amount of consumption and saving with respect to a unit of income are necessarily mirror images in a fixed moment of time, this does not hold when we consider the dynamics of consumption and saving. With regional Spanish data we find that the same set of exogenous variables has rather different impacts on consumption growth and saving rates.

The standard consumption theory indicates that increased current savings reduce current consumption, but foster future consumption (agents allocate intertemporally their income to smooth consumption through time). However, when macroeconomic uncertainty about future income increases over time, the consumption of accumulated saving is postponed. This is especially relevant to the Spanish economy because of the very high level of household financial leverage (according to IMFb, 2012, calculations, household sector had a debt/GDP ratio of 136% of disposable income in 2010); the implosion of the housing bubble, which is reducing the value of real estate assets and, therefore, of non-financial wealth; and finally the increased difficulties in the access to credit, along with lack of confidence in the performance and solvency of the banking system. Thus, increased savings today will not feed consumption in the future and, therefore, will not trigger investment and the creation of employment through an expansion in demand (Bande and Riveiro, 2012). Even worse, the rise in unemployment will create more uncertainty, which in turn will increase further saving rates and worsen the state of the labour market. The aforementioned factors lead to a vicious circle of greater uncertainty, increased precautionary saving, weaker aggregate demand and higher unemployment, which in turn leads to more uncertainty.

These results are significant at the macroeconomic policy design level, given that they suggest that the measures currently focused on the flexibilization of the labour market (which, as the evidence shows, are not reducing the unemployment rate and, therefore, are increasing uncertainty) will increase precautionary saving rates. According to our results, the only way to break this vicious circle is to directly stimulate consumption, which would have a direct effect on investment (Bande *et* al, 2011, Bande and Riveiro, 2012). This would increase employment and reduce the unemployment rate. The reduction in the level of uncertainty regarding future income in a context of decreasing unemployment rates lowers precautionary saving rates and increases current consumption, which will lead to a virtuous circle of increased production and employment. How to achieve this fiscal boost without compromising fiscal balances is a different matter, and is clearly out of the scope of this paper, but is left for future research.

References

1. Andres, J., Molinas, C. and D. Taguas, 1990, Una Función de Consumo Privado para la Economía Española: Aplicación del Análisis de Cointegración. Cuadernos Económicos del ICE, 44, 173-212.
2. Arellano, M. and S. Bond, 1991, Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies, 58: 277-297
3. Argimón, I., González-Páramo, J.M. and J.M. Roldán, 1993, Ahorro, Riqueza y Tipos de Interés en España. Investigaciones Económicas, 17(2), 313-332.
4. Attanasio, O. (1999), Consumption. In Handbook of Macroeconomics, vol 1. Edited by J.Taylor and M. Woodford. Elsevier Science, Amsterdam.
5. Bande. R., Fernández-Grela, M. and D. Riveiro, 2011, Consumption, Saving, Investment, and Unemployment. SVAR Tests of the Effects of Changes in the Consumption-Saving Pattern. IDEGA, Área de Análise Económica, Working Paper nº 45.
6. Bande, R. and D. Riveiro, 2012, La Relación Consumo-Inversión-Desempleo en España: un análisis con datos regionales. IDEGA, Área de Análise Económica, working paper nº 49.
7. Bandiera, O., Caprio, G., Honohan, P. and F. Shciantarelli, 2000, Does Financial Reform Raise or Reduce Saving?. Review of Economics and Statistics, 82(2), 239-263.
8. Baltagi, B.H., 2008, Econometric Analysis of Panel Data, 4th edition. Wiley, New York.
9. Barceló, C. and E. Villanueva, 2010, Los Efectos de la Estabilidad Laboral sobre el Ahorro y la Riqueza de los Hogares Españoles. Banco de España, Boletín Económico, June, 81-86.
10. Blundell, R., and S. Bond, 1998, Initial conditions and moment restrictions in dynamic panel data models. Journal of Econometrics, 87, 115-143.
11. Bosworth, B., and G. Chodorw-Reich, 2007, Saving and Demographic Change: The Global Dimension. Center for Retirement Research at Boston College, Working Paper 2007-2.
12. Campbell, J.Y. and G. Mankiw, 1989, Consumption, Income and Interest Rate: Reinterpreting the Time Series Evidence. In Macroeconomic Annual. Edited by O.J. Blanchard O.J. and S. Fisher. MIT Press, Cambridge, MA.
13. Carroll, C.D., 1992, The Buffer-Stock Theory of Saving: Some Macroeconomic Evidence, Brookings Papers on Economic Activity, 2, 61-127.

14. Carroll, C.D., 1994, How Does Future Income Affect Current Consumption?. Quarterly Journal of Economics, 109, 111-147.
15. Carroll, C.D., 1997, Buffer-Stock Saving and the Life Cycle/Permanent Income Hypothesis. The Quarterly Journal of Economics, Vol. 112 (1), 1-55.
16. Carroll, C.D. and L. Summers, 1987, Why Have Private Savings Rates in the Uinted States and Canada Diverged?. Journal of Monetary Economics, 20, 249-279.
17. Cook, J.C., 1995, Savings Rates and Income Distribution: Further Evidence from LDC. Applied Economics, 27, 71-82.
18. Cuadro-Sáez, L., 2011, Determinantes y Perspectivas de la Tasa de Ahorro en Estados Unidos. Banco de España, Boletín Económico, April 2011, 111-121.
19. Dreze, J. and F. Modigliani, 1972, Consumption Decision under Uncertainty. Journal of Economic Theory, 5, 308-335.
20. Dynan, K., 1993, How Prudent are Consumers?. Journal of Political Economy, 101, 1104-113.
21. Dynarski, M. and S. Sheffrin, 1987, Consumption and Unemployment. Quarterly Journal of Economics, 102, 411-428.
22. Edwards, S., 1996, Why are Latin Americans Savings Rates so Low? An International Comparative Analysis. Journal of Development Economics, 51, 5-44.
23. Graham, J., 1987, International Differences in Saving Rates and the Life Cycle Hypothesis. European Economic Review, 31, 1509-1529.
24. Graham, J., 1989, International Differences in Saving Rates and the Life Cycle Hypothesis. Reply and Further Evidence. European Economic Review, 33, 1499-1507.
25. Guarilia, A. And B.Y. Kim, 2003, The Effects of Consumption Variability on Saving: Evidence from a Panel of Muscovite Households. Oxford Bulletin of Economics and Statistics, 65, 357-377.
26. Guiso, L., Japelli, T. and D. Terlizzese, 1992, Earnings Uncertainty and Precautionary Saving. Journal of Monetary Policy, 30, 307-337.
27. Hahm, J.H., 1999, Consumption Growth, Income Growth and Earnings Uncertainty: Simple Cross-Country Evidence. International Economic Journal, 13, 39-58.
28. Hahm, J.H. and D.G. Steigerwald, 1999, Consumption Adjustment under Time-Varying Income Uncertainty. Review of Economics and Statistics, 81, 32-40.

29. Horioka, C. and A. Terada, 2010, Determinants and Long-term Projections of Saving Rates in Developing Asia. Asian Development Bank, ADB Economics working paper 228.
30. International Monetary Fund, 2012, Spain: Financial System Stability Assessment. IMF Country Report, nº 12/137
31. Japelli, T. and M. Pagano, 1994, Saving, Growth and Liquidity Constraints. Quarterly Journal of Economics, 109, 83-108.
32. Kazarosian, M., 1997, Precautionary Savings: A Panel Study. Review of Economics and Statistics, 79(2), 241-247.
33. Kessler, D., Perelman, D. And P. Pestieau, 1993, Savingd Behaviour in 17 OECD Countries. Review of Income and Health, 39(1), 37-49.
34. Kimball, M. S., 1990, Precautionary saving in the Small and in the Large. Econometrica, 58, 53-73.
35. Leland, H., 1968, Saving and uncertainty: the Precautionary demand for Saving. Quarterly Journal of Economics, 82, 465-473.
36. Loayza, N., Schimdt-Hebbel, K. and L. Servén, 2000, What Drives Private Saving Across the World?. Review of Economics and Statistics, vol 82(2), 165-181
37. Lusardi, A., 1998, On the Importance of the Precautionary Saving Motive. American Economic Review Papers and Proceedings, 88, 449-453.
38. Lyhagen, J., 2001, The Effect of Precautionary Saving on Consumption in Sweden. Applied Economics, 33, 673-681.
39. Malley, J. and T. Moutos, 1996, Unemployment and Consumption. Oxford Economic Papers, 48, 548-600.
40. Marchante, A., Ortega, B. and F. Trujillo, 2001, Regional Differences in Personal Saving Rates in Spain. Papers in Regional Science, 80, 465-482.
41. Menegatti, M., 2007, Consumption and Uncertainty: a Panel Analysis in Italian Regions. Applied Economics Letters, 14, 39-42.
42. Menegatti, M., 2010, Uncertainty and Consumption: New Evidence in OECD Countries. Bulletin of Economic Research, 62(3), 227-242.
43. Modigliani, F., 1993, Recent Declines in the Savings Rates: A Life Cycle Perspective. In World Saving Prosperity and Growth . Edited by M. Baldassari, L. Paganetto and E. Phelps. McMillan Press and St. Martin's Press, Rome.
44. Mody, A., Ohnsorge F. and D. Sandri, 2012, Precautionary Savings in the Great Recession. IMF Working Paper WP12/42.
45. Rebelo, S., 1991, Long Run Policy Analysis and Long Run Growth. Journal of Political Economy, 99.

46. Romer, P., 1986, Increasing Returns and Long Run Growth. Journal of Political Economy, Vol. 94 (5), 1002-1037.
47. Sastre, T. and J.L. Fernández-Sánchez, 2011, La Tasa de Ahorro Durante la Crisis Económica: el Papel de las Expectativas de Desempleo y de la Financiación. Banco de España, Boletín Económico, November, 63-77.
48. Smith, R.P. and A.M. Fuertes, 2010, Panel Time-Series, mimeo.