# Effects of Uncertainty on Household Saving Rate

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17 June 2013

# Effects of Uncertainty on Household Saving Rate

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**Abstract**

In this master thesis we attempted to investigate the role of economic uncertainty in driving the behavior of household savings for six European countries: Germany, France, Finland, United Kingdom (UK), Portugal and Italy. We focused on three main sources of economic uncertainty: Unemployment Risk, Fiscal Policy Uncertainty and Financial Crisis-Investment risk. We used Unemployment rate as a proxy for labor income uncertainty and the risk of an income loss. We computed the volatility of financial stock prices for each country as an indicator for the presence of a financial crisis. With regard to policy uncertainty, we employed three different measures: a Policy Uncertainty Index constructed by Baker, Bloom, and Davis; Debt to GDP ratio and Government Surplus / Deficit over GDP. We estimated first a Structural Vector Autoregressive (SVAR) model, separately for each country, using quarterly data from 1999 to 2012 and we compared country-specific impulse responses on savings rates. We found that household savings rate reacts in response to fiscal and unemployment shocks differently in each country, whereas we didn't find any significant response to financial stock price volatility. We then proceeded with the Bayesian estimation of the reduced form VARs for the panel of countries mentioned above as a Hierarchical Linear Model. We focused our analysis on the Average Impulse Responses with the aim of analyzing the aggregate effect on household savings of shocks shared by all countries.

# Contents

# I. Introduction

The theoretical literature suggests a variety of motives for household saving. In broad term, these motives can be grouped into four categories: to provide resources for retirement and bequest, to finance expected large life time expenditures, to finance unexpected losses of income, and to smooth the availability of financial resources over time to maintain a more stable consumption profile. These saving motives, in turn, suggest a large number of variables that may influence household saving decisions.

This master thesis seeks to investigate the role of economic uncertainty in driving the behavior of household savings for some European countries : greater uncertainty or worsening in economic circumstances is expected to increase the incentive of households to save as they pursue to protect themselves against the higher likelihood of adverse outcomes.

We focused on three main sources of economic uncertainty:

1. Unemployment risk : an increase in labor income uncertainty stimulates saving rates since households accumulate a larger stock of wealth to offset larger or more frequent adverse shocks.
2. Financial Uncertainty (Investment risk) : the response of the saving rate to changes in investment risk is subject to two counterbalancing effects, an higher uncertainty stimulates savings but the risk of capital losses deters saving therefore the overall impact is ambiguous.
3. Fiscal Policy Uncertainty : according to the Ricardian Equivalence hypothesis, private sector savings adjust in response to public sector deficits and surpluses so as to tax policies.

As economic shocks result usually from normal business cycles, financial frictions, and economic restructuring, due to such shocks, households experience tough periods of unexpected reduction in income. According to the Life-Cycle and Permanent Income Hypothesis,

households would save more to smooth their consumption during their entire life and to avoid future uncertainty.

During the recent financial crisis (2008), fiscal austerity measures have been introduced by most national governments in Europe in order to tackle the outstanding sovereign debt. In periods of financial and economic crisis, fiscal policy measures and related uncertainty may also affect household consumption and saving decision.

Moreover financial and economic crisis lead to unemployment in the economy, and the risk of future uncertainty in income makes households to save more. When significant portion of households are affected due to future uncertainty of losing job this often translates into deficiency in demand and consumption which can furthermore lead to economic downturn. Financial crisis can also take place when the labor market is deteriorated with the threat of unemployment, as a result, households may change the portfolio of their savings towards safer asset rather than risky asset.

Accordingly, any sort of financial crisis resulting in recession has a significant impact on household savings.

In this paper six countries have been used for the purpose of our analysis: Finland, France, Germany, Italy, Portugal and United Kingdom (UK).

The empirical framework used in this paper is segmented in two parts. Firstly, we analyze the influence of shocks on savings rate using Structural Vector Autoregressive technique, (SVAR) individually for each country and check the Impulse responses. The goal of this work is to compare how the households react to shocks in the separate countries, if they are reacting in the same way or differently. Secondly, we compare the impulse responses to shocks across the countries.

Because of limited observation due to short period data, we applied Bayesian Method, without forcing the countries to have the same identical parameters, reactions to shocks, but allowing them to slightly differ among each other..…... assuming household savings rate will not react significantly different across the countries.

This prior which pools information across countries results in posterior using the scarce data.

The rest of the paper is structured as follows: Section 2 provides a brief description of the variables and the data and the empirical analysis; the discussion regarding empirical results are laid out in Section 3 while section 4 concludes.

# II. Empirical Analysis

## i) Data

The sample data set for the six European countries analyzed, comprises quarterly data covering the period 1999-2012. Data have been collected from three main databases: Eurostat, OECD and Bloomberg.

The main variable of interest is household saving rate[1]: it is calculated by dividing gross saving by gross disposable income, the latter being adjusted for the change in the net equity of households in pension funds reserves. This adjustment consists in adding to the household disposable income the increase in pension funds reserves which are considered as owned by households but recorded in the disposable income of the financial corporations sector. The gross saving rate is calculated without accounting for the depreciation of fixed assets (mainly dwellings).[2]

We use Unemployment rate[3] as a proxy for labor income uncertainty and the risk of an income loss: it is defined as the number of unemployed persons expressed as a percentage of the labor force[4].

[1] Eurostat statistic.

[2] The household sector covers individuals or group of individuals whose principal function is consumption. It also includes own-account workers or entrepreneurs and unincorporated partnerships producing goods and services, when their activities cannot be separated from those of their owners (in particular, they do not keep a separate set of accounts). It may include a higher (e.g. Italy) or lower proportion of unincorporated enterprises depending on the structure of the economy. This may impact on saving and investment rates (the household sector is sometimes complemented by non-profit institutions serving households including charities, trade-unions, churches, political parties, sports clubs etc.).

[3] Bloomberg statistic.

[4] For statistical purposes, the labor force is classed as the non-institutionalised civilian population aged 15 years and over who are either employed or unemployed at the time of survey.

With regard to policy uncertainty, we employed three different measures:

- Policy Uncertainty Index : we averaged monthly data of economic policy uncertainty from 1999 to 2012 over each quarter. Data are obtained from the Economic Policy Uncertainty Index website located at http://www.policyuncertainty.com; this index is constructed by Baker, Bloom, and Davis (2012)[5].
- Debt to GDP ratio[6]: the indicator is defined (in the Maastricht Treaty) as consolidated general government gross debt at nominal value, outstanding at the end of the year in the following categories of government liabilities: currency and deposits, securities other than shares excluding financial derivatives, and loans. Basic data are expressed in national currency, converted into euro using end-year exchange rates for the euro provided by the European Central Bank (ECB).
- Government Surplus / Deficit over GDP[7]: The general government deficit/surplus is defined in the Maastricht Treaty as general government net borrowing/lending according to the European System of Accounts. It is the difference between the revenue and the expenditure of the general government sector. The series are presented as a percentage of GDP. GDP used as a denominator is the gross domestic product at current market prices.

Finally, in order to focus on investment risk and related financial market uncertainty, we use a measure of the stock market volatility. In particular we computed the volatility of the domestic stock market per each country, measured as the standard deviation of daily changes in the stock market index over each quarter[8].

Table 1 presents mean and variance computed over the sample period, for:

- HSR: Household Saving Rate
- STD_FS: Price Volatility of the Financial Stock
- UR: Unemployment Rate

[5] The detailed methodology of how the index is developed can be accessed at http://www.policyuncertainty.com/methodology.html
[6] Eurostat statistic.
[7] Eurostat statistic.
[8] Financial stock used per each county: Italy MIB 30, German DAX, France CAC40, Portugal PSI 20, Finland HEX 25, United Kingdom UKX FTSE100.

| | Table 1: Descriptive Statistics | | | | | |
|---|---|---|---|---|---|---|
| | **HSR** | | **STD_FS** | | **UR** | |
| | **M** | **$\sigma^2$** | **$\mu$** | **$\sigma^2$** | **M** | **$\sigma^2$** |
| **Italy** | 0.15 | 0.00037 | 1154.64 | 571768.17 | 8.42 | 1.94 |
| **Germany** | 0.16 | 0.00005 | 235.14 | 18410.94 | 9.23 | 2.23 |
| **France** | 0.15 | 0.00006 | 159.02 | 7311.53 | 7.78 | 0.43 |
| **Uk** | 0.05 | 0.00039 | 152.19 | 5425.19 | 6.03 | 1.52 |
| **Portugal** | 0.09 | 0.00043 | 299.97 | 26818.41 | 8.88 | 10.35 |
| **Finland** | 0.09 | 0.00044 | 99.40 | 3493.49 | 8.39 | 1.05 |

As we can see from the table above, the average of the household interest rate is almost the same among Italy, Germany and France. On the other side, UK, even it is considered to be a very developed country, presents a very low saving interest rate due to many reasons like: high availability of credit, low interest rate, high incentive in borrowing.
The average of the Unemployment rate is quite similar among all the countries.

Table 2 shows the main statistical properties for the variables used as indicators for
Policy Uncertainty:

- D_ GDP : Debt to GDP ratio
- D_S_GDP: Deficit/Surplus to GDP ratio
- PU: Policy Uncertainty Index

We can infer from the table the average behavior of each country over time with respect to two main macro variables: debt and deficit/surplus ratio to GDP. The countries that nowadays are suffering more because of the crisis are those countries presenting the highest rate of debt and deficit over time such as Italy and Portugal. Finland presents a low average debt rate and it is the only country that presents an average surplus over the sample period.

| | Table 2: Descriptive statistics | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **D_GDP** | | | **D_S_GDP** | | | **PU** | |
| | **M** | **$\sigma^2$** | **min Max** | **μ** | **$\sigma^2$** | **min Max** | **μ** | **$\sigma^2$** |
| **Italy** | 111.70 | 41.61 | 103.30<br>127.20 | -3.26 | 2.14 | -6.48<br>0.62 | 105.81 | 1166.78 |
| **Germany** | 68.55 | 53.38 | 58.70<br>82.50 | -1.97 | 4.95 | -7.49<br>7.62 | 109.85 | 913.85 |
| **France** | 156.90 | 6452.72 | 54.79<br>429.60 | -3.77 | 3.70 | -8.35<br>0.46 | 113.71 | 2228.40 |
| **UK** | 52.26 | 320.95 | 37.00<br>90.00 | -3.82 | 17.45 | -11.99<br>6.68 | 119.52 | 4476.58 |
| **Portugal** | 72.49 | 401.33 | 50.4<br>123.6 | -5.26 | 10.68 | -11.57<br>3.77 | --- | --- |
| **Finland** | 42.20 | 25.33 | 29.90<br>53.00 | 2.24 | 10.50 | -4.16<br>9.51 | --- | --- |

All data are either in ratio or in rate form so they are unit free. HSR STD_FS UR PU , D_ GDP D_S_GDP.

For the estimation we have used Matlab and to check the accuracy of the result we also used Gretl and Eviews. All the programs provided the same result.

## ii) SVAR Analysis

Before performing the vector autoregression analysis we checked the Unit root for all the series using the Augmented Dickey Fuller test. In some cases we found unit root due to our limited time series, but in a long run perspective our regressors are stationary . This is the reason we kept the data in the level form to perform the estimation. Moreover we seasonally adjusted the HSR variable and the Deficit/Surplus to GDP ratio.

Appropriate length of lags to be included in the model has been chosen based on the Akaike's information criterion (AIC) and the Hannan and Quinn information criterion (HQIC) tests as we are working with the quarterly data. Both criterions suggested to use two lags for all our variables.

Before proceeding with the econometric analysis, the usual cautionary remarks are needed when using macro data. We follow the savings literature and interpret our regressors as reasonable determinants of household saving rates. But still the concern about endogeneity remains. For example, there might be some reverse causality from savings to unemployment as an exogenous increase in saving reduces aggregate demand and labor demand. This concern is, at least, somewhat less important than in older analysis of saving rates, since the process of globalization over the last two decades has reduced the dependence of domestic production on domestic demand and financing. Finally, there is always the possibility that some omitted variable might be causing a spurious correlation between saving rates and the regressors.

The SVAR (structural vector autoregressive) model can be used to identify the shocks to be traced in an impulse response analysis, by imposing restrictions on the coefficient matrices in the model. To ensure that plausible restrictions are obtained it is necessary to adjust the order of the variables; this is done by using Cholesky factor.

The Wold representation for our SVAR model is:

$$Y_t = A(L)Y_{t-1} + e_t$$

Where, considering a two lags specification,

$$Y_t = \begin{bmatrix} HSR_t \\ X_t \\ UR_t \\ Z_t \\ HSR_{t-1} \\ X_{t-1} \\ UR_{t-1} \\ Z_{t-1} \end{bmatrix}_{8x1} \quad ; \quad A(L) = \begin{bmatrix} C_1 & C_2 \\ I & 0 \end{bmatrix}_{8x8} ; \quad e_t = \begin{bmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \\ 0 \\ 0 \\ 0 \\ 0 \end{bmatrix}_{8x1}$$

- $HSR_t$= Savings Rate,
- $X_{it}$= Stock Index Price Volatility,
- $UR_t$= Unemployment Rate ,
- and $Z_t$ represents the third variable which can be Policy Uncertainty PU, Debt Over GDP (D_GDP) or Government Deficit/ Surplus to GDP ratio (D_S_GDP),
- A(L) correspondent matrix of coefficients.
- $e_t$ vector of random disturbances.

### a. Cholesky Identification

A crucial issue in the estimation of a structural model is always the identification of the empirical model. Identification in simultaneous equation models is typically achieved by imposing exclusion restrictions on the elements of the coefficients matrices. These restrictions are imposed on the model on a priori grounds and cannot be tested. For this reason they should be based on a firm theoretical foundation. In our analysis we referred to the standard Cholesky Factorization procedure to orthogonalize the shocks.

In any SVAR the identification problem is very important and in the paper we have used three different ordering for our analysis. The following part provides the economic reasons behind choosing the orders.

In order to analyze a structural VAR, one of the most important step is the order of the variables in the Cholesky decomposition. A change in the order can cause completely different impulse response function and results. In this paragraph we are giving the motivation that explains each order according to several empirical papers.

We have chosen three different orders for the Cholesky decomposition according to the variables that we have taken into account. We have three constant variables (savings rate, unemployment rate and standard deviation of the Financial stock prices of each country) and three variables that change all the time (policy uncertainty index, debt over GDP and deficit over GDP). Summarizing, the three orders are as follows:

1) Stock Index Price Volatility per country,Unemployment Rate,Savings Rate,Deficit over GDP;

2) Stock Index Price Volatility per country, Unemployment Rate, Savings Rate, Debt over GDP;
3) Stock Index Price Volatility per country,Policy Uncertainty,Unemployment Rate,Savings Rate.

These orders come from some empirical reasons explained in different papers.

As it is shown above, the very first variable chosen for all of the three orders is the standard deviation of each stock index. This choice comes from the paper written by Beaudry and Portier (2006) about the capability of the stock index in capturing today the future shocks such that in technological innovation, consumption, investment, hours worked and so on and so forth. Stock prices are considered to be a good indicator in reacting to any changes in agents expectations regarding future economic conditions. As a matter of fact, one of the most important characteristic of the stock prices is that it is an unhindered jump variable which means that, as soon as a piece of new information is given, the stock prices can immediately react to those changes without lag; as an example we have that permanent changes in TFP are reflected in stock prices even before the actual increase in productivity occurs. This happens because of the existence of a lag, in the TFP variable, between the moment that agents recognize a technological innovation and its actual impact on productivity in the economy. The theory just introduced is called new view and it is the one that we agreed for our first variable (standard deviation of the stock exchange of each country) for the Cholesky order.

The above reasons explain why we decided to put the standard deviation of each stock index as a first variable for all the three different order of the Cholesky decomposition. After that variable we agreed in having unemployment and savings rate as second and third variable (for order 1 and order 2). The main reason is explained in an empirical paper written by Xin Meng (2003). The main hypothesis is the existence of a permanent income and risk averse households who prefer to smooth their consumption. In fact, households start saving when realized income is higher than expected income. In the opposite case, where realized income is lower than the expected one, we have that households, in order to finance their current consumption, either borrow or withdraw money from saving. This last reasoning is in line with the countercyclical behavior that suggests to save during normal periods or when high incomes are uncertain and dissave during adverse

period due to negative economic shock such that unemployment. As a matter of fact, an increase in the unemployment rate causes a decrease in income and consequently this shock reduces the expected income and the uncertainty of any household. The last effect is the use of previous savings in order to be able to smooth consumption in difficult period too. The same reason is explained also in another paper written by Christoph Basten (2013) which confirms the order that we chose that is unemployment first and savings after.

The reason why we chose to order savings before debt comes from a speech held by Ben S. Bernanke at the Sandridge, Virginia Association of Economist. The reason is that, since most of the countries live in an open economy and international capital markets are well-developed, it can happen that the investment of a country can be higher than its saving. In that case a country with an excess in savings can lent this last one on the international capital market and finance those countries which present a shortfall; in that way the gap is closed. An excess in investment causes a higher amount of bonds issued which cause consequently a rise in the government deficit for that year. In fact, the excess coming from the ratio between investments over saving in a country is equal to its current account deficit.

Moreover we know that deficit of every year is summed up in order to obtain the debt which is a stock variable. This reasoning explains also the reason why we put debt after savings as we did with the deficit.

The third order of the Cholesky decomposition is composed by the three common variables and by a new variable denoted as policy uncertainty already described in the introduction. Since this index includes several components and one of them is the frequency of news coming from different means of communication, we decided to judge it as a stock index variable which incorporates instantaneously news coming from the economic and financial market (according to Baudry and Portier paper). Since the policy uncertainty index is due to also other components different from news we decided to put it just right after the standard deviation of the stock index variable.

There is also a study that confirms this order which is written by Vichet Sum (2013). He studied the impulse response function of economic policy uncertainty and financial stress through a VAR analysis. The final result was that the economic policy uncertainty reacts immediately to a shock due to a financial stock index. As a matter of fact, according to this study, a financial stress plays a very important role in an economic environment because all the economic agents, including financial institution, businessman and consumers, are more unsecure about investing, lending and consuming. All these variables are reduced and consequently all the components of policy uncertainty are attacked and this last index increases.

Policy uncertainty then causes and increases in the cost of credit which incentive firms to delay their investment instead of financing them; this creates a shortfall in production and employment or at least a freezing in hiring new employees. All these variables change due to the original financial stress incorporated in the stock index. An immediate consequence is a higher policy uncertainty followed by an increase in the unemployment rate.

## b. Impulse Responses Analysis

In the following paragraphs we analyze the cumulative impulse response of saving rate to the shock of each variable. We are dealing with cumulative impulse responses because we want to focus on the long run effect. The confidence interval for the error band is 0.68.

1. Policy Uncertainty

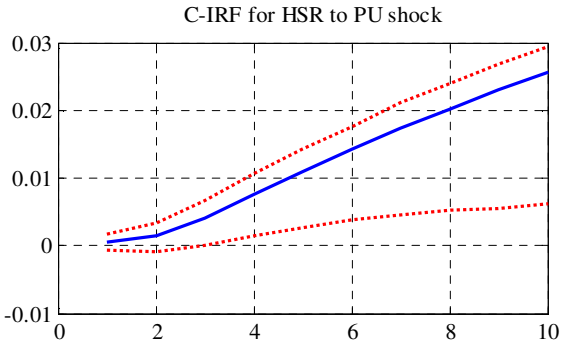
Recently, many commentators have argued that policy-related uncertainty has been a key factor slowing the recovery from the recession of 2007-2009. The claim is that businesses and households are uncertain about future taxes, spending levels, regulations, health-care reform, and interest rates. In turn, this uncertainty leads them to postpone spending on investment and consumption goods and to slow hiring, impeding the recovery.

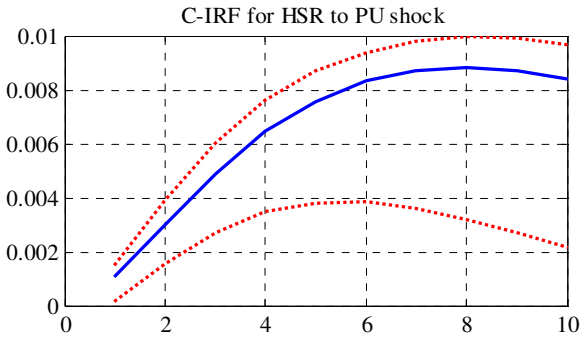
Our research seeks to investigate to what extent this source of uncertainty affected household saving rate. To do so, we included in our empirical model an indicator for policy uncertainty. We employed three measures to account for that.

First, we use a "Policy Uncertainty Index": this index appears to be available for the European Union as an aggregate and individually for only five countries (Italy, Germany, France, UK and Spain. However, for Spain the index has been built from the year 2005 onwards, hence we didn't include it in our analysis due to the too short time series).

Figure 1. Cumulative Impulse responses to Policy Uncertainty shocks in UK and France

| UK | France |
|---|---|




Household saving accumulated impulse responses to this indicator were significant only for two countries: UK and France; as you can see in Figure 1 they are both positive. The other two countries, Italy and Germany, for which the index was available, showed impulse responses around zero.

Given the unsatisfactory results obtained in using the Nick Bloom Index as possible indicator for the fiscal policy uncertainty, we proceeded with two additional estimations of the model by replacing this regressor once with the government debt-to-gdp and secondly with the deficit / surplus to gdp ratio.

As previously mentioned, the availability of the Nick bloom index was limited to only a few countries, therefore the use of these two different variables allowed us to extend our analysis to other two countries: Finland and Portugal.

Although the latter two variables are closely related (GDP ratio and Deficit/Surplus ratio), the impulse response functions of some countries are highly significant and well-shaped when considering either one or the other indicator.

**Figure 2**

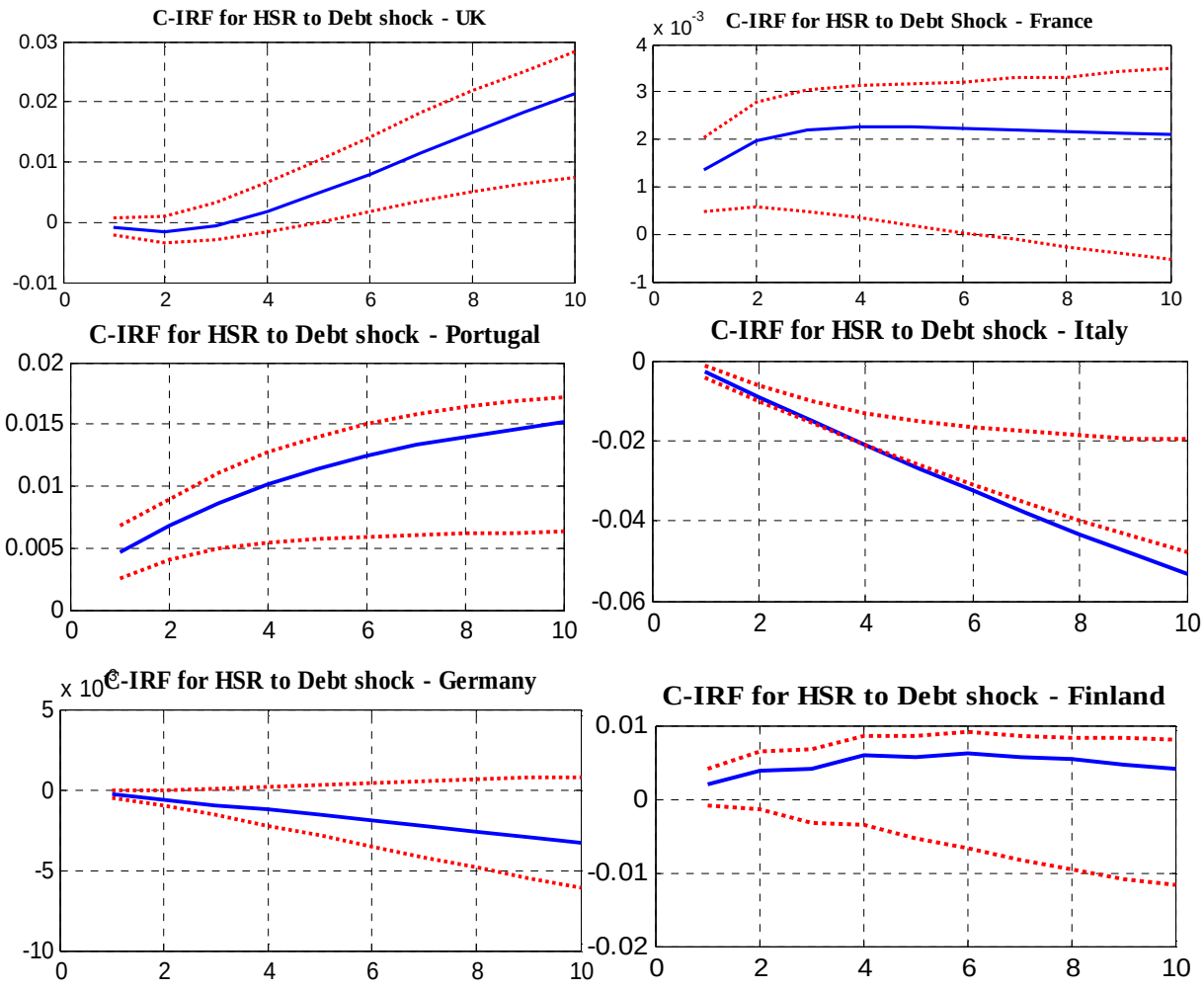


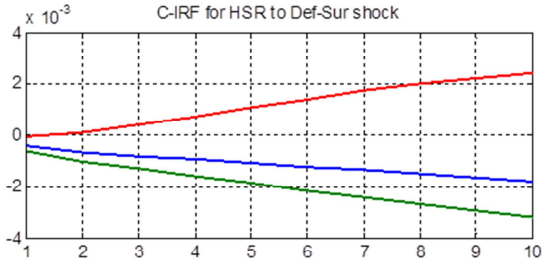

Figure 2 allows a comparison of individual countries' accumulated impulse response of Household saving rate to a shock in the debt to gdp ratio. Here we can see that the cumulative impulse response functions are significant for UK, Portugal and France. For the first two

countries they show an upward trend while France increases slightly at the beginning and then stabilizes over time.

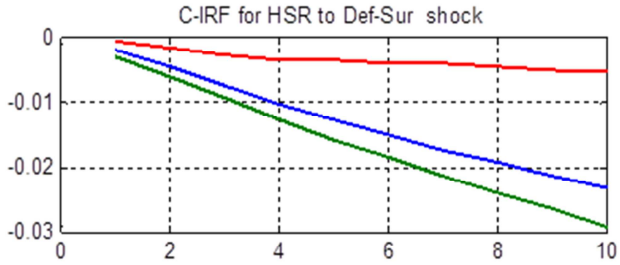
Figure 3 shows impulse responses to a shock in the deficit/surplus to gdp ratio.

**Figure 3**

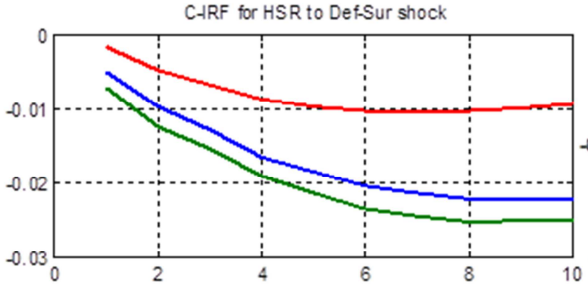
*Germany*



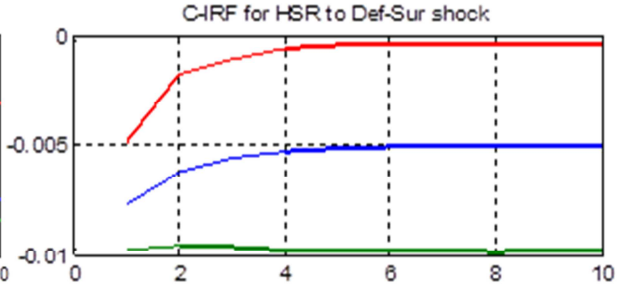

*UK*



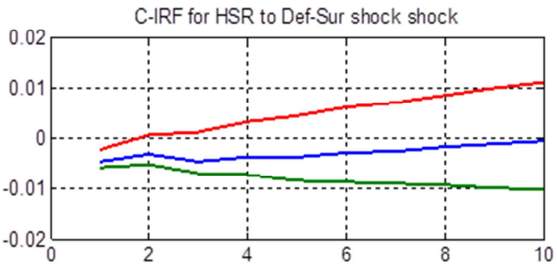

*Finland*



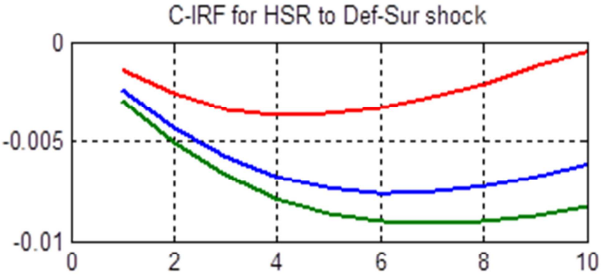

*Portugal*




*Italy*




*France*




As expected, comparing to the previous shock, the sign is reversed when the deficit/surplus ratio to GDP is used; however, in this case the cumulated impulse responses are significant only for

UK and Finland and both of them present a downward trend. There are other two countries, Portugal and France that can be considered as very slightly significant. Portugal shows a soft increase and then stays constant while France decreases at the beginning and then increases slowly.

The above results would partially confirm the idea that fiscal policy can also influence the savings pattern of the private sector. The Ricardian equivalence hypothesis, which we mentioned earlier, suggests that private sector savings adjust in response to public sector deficits or surpluses (Ferrucci and Miralles 2007). A decline in the government fiscal balance (increase in the deficit) is associated with higher household savings, possibly capturing Ricardian effects: as public savings decreases, the government will finance its spending through taxes or by issuing bonds. Since the government will eventually repay the bonds/debt by raising taxes, taxpayers will have to pay higher taxes in the future. They therefore put aside their savings now in anticipation of future taxes increases. In other words a decline in public savings is offset by a rise in private savings (Hondroyiannis 2006). If this equivalence holds, the private savings rate is negatively correlated with public savings. Empirical results seem to support these suspicions: the estimated coefficients of saving rate and government budget surplus are significantly negative across studies.

An analogous reasoning can be done, when instead of considering an increase in government spending we consider what is called expansionary fiscal consolidations**.** The hypothesis of **expansionary fiscal consolidations,** whether for fiscal consolidation we consider an improvement of the (primary) budget balance, either in terms of its size or in terms of the period during which the consolidation occurs, was echoed by the so-called German view, expressed in 1981-1982 by the German Council of Economic Experts [see Hellwig and Neumann (1987)].
The idea of expansionary fiscal consolidations relates also to the possibility of non-Keynesian effects of fiscal policy, resulting from the creation of expectations by Consumers, which may reverse the sign of the traditional Keynesian multipliers. For instance, if non-Keynesian effects dominate, a fiscal consolidation can lead to higher private consumption and economic growth.
Such perspective was to some extent reflected in the fiscal convergence criteria of the Maastricht Treaty. Expansionary fiscal consolidations were initially studied for Denmark in 1983-86 and Ireland in 1987-89 [Giavazzi and Pagano (1990)].

A key point in the explanatory statement proposed is the **expectations of economic agents** ("expectations view", "expectational view of fiscal policy"). If a fiscal consolidation is seen as a serious and sustained attempt to decrease government debt, it can induce a wealth effect. Such wealth effect may lead to higher private consumption (decrease in savings) since consumers have expectations of lower future taxes. Lower government indebtedness reduces the risk premium and the real interest rate for government debt, allowing some *crowding-in* of private investment (or at least mitigating the *crowding-out*).

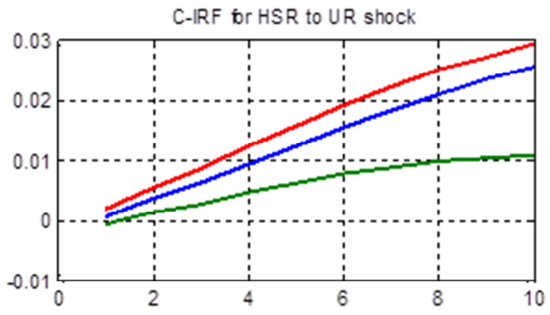
Moreover, saving rates are also decreasing in the old dependency ratio as predicted by life-cycle theories.

2. Unemployment Rate

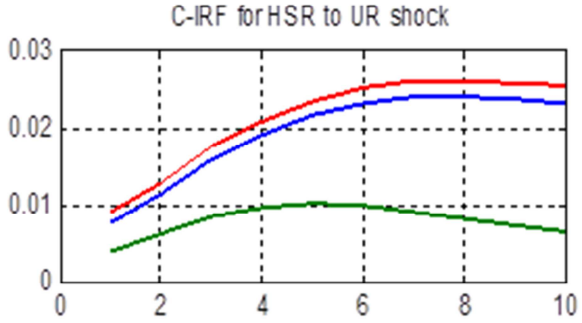
The effect of the unemployment rate on household savings, instead, is not as definite. The unemployed tend to have lower savings, similar to the retired, which adds downward pressures on the household savings rate. On the other hand, a higher unemployment rate generally, indicates higher uncertainty in society, inducing households to save more. The empirical results of Edwards (1995) seem to favour the former explanation.

**Figure 4**

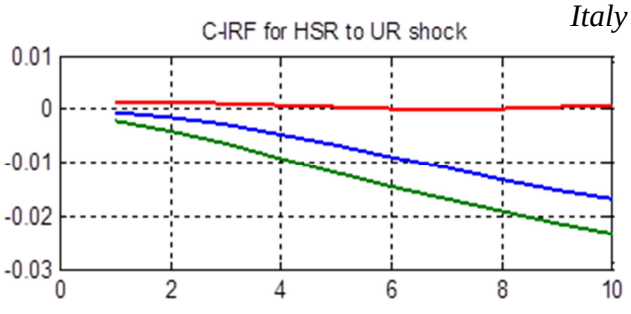
*UK*



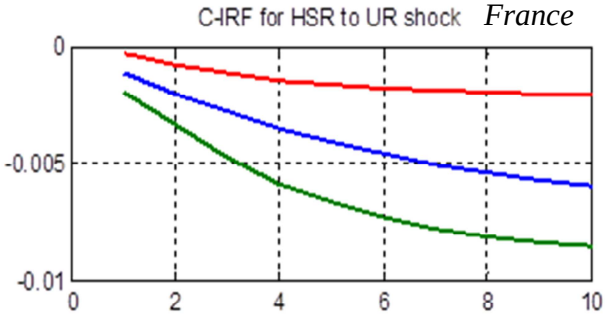

*Finland*



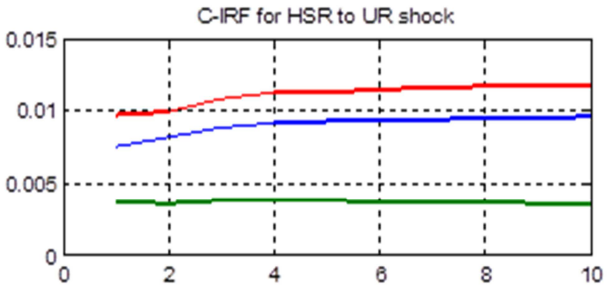

*Italy*




*France*



*Portugal*




As we can observe from figure 4 unemployment is detrimental to saving for two countries Italy and France, suggesting that the impact from lower incomes dominates the positive effect from the increased need for saving due to higher uncertainty.

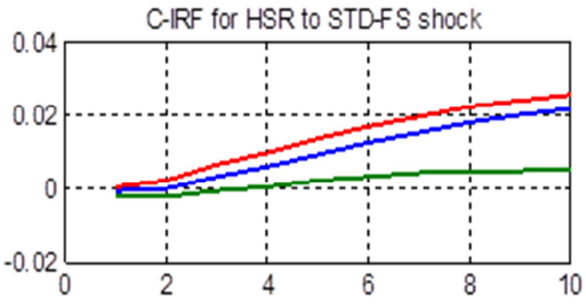
While instead impulse responses of HSR to Unemployment shock are positive for UK, Finland and Portugal. This could suggest that greater labor income uncertainty is significantly associated with higher household savings, hence saving rate increases in response to higher unemployment. An increase in labor income uncertainty stimulates saving rates since households accumulate a larger stock of wealth to offset larger or more frequent adverse shocks. Hence, for those countries higher unemployment may lead to higher saving rates by increasing labor income risk and also by reducing expected income.

3. Investment-Financial risk

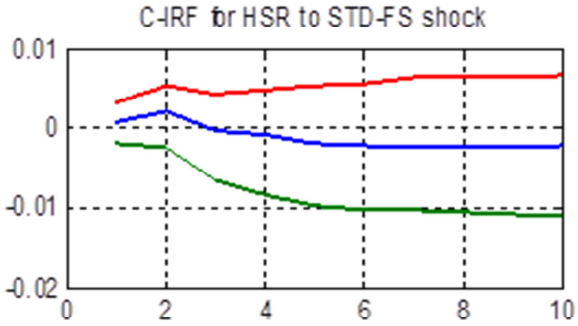
**Figure 5**

*Germany*

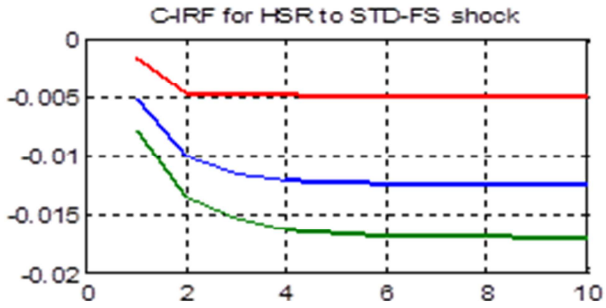

*UK*



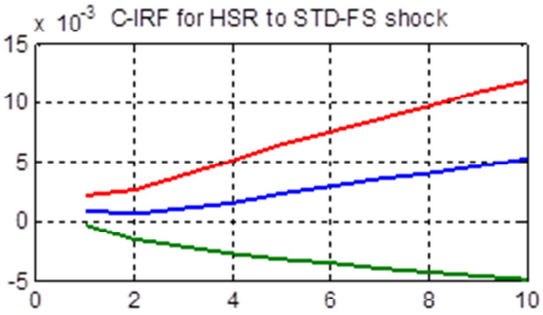
*Finland*



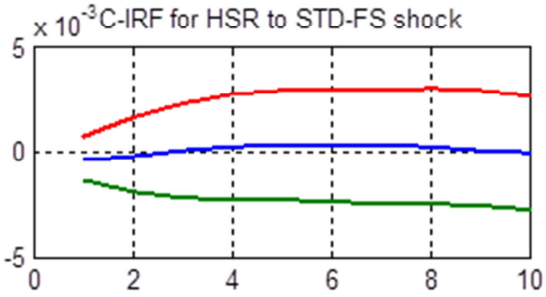

*Portugal*




*Italy*




*France*




Concerning investment/financial risk—measured by the volatility of the stock market—from figure 5 we can observe that it does not have a significant impact on the saving rate for almost all countries.

This is mainly due to the fact that the response of the saving rate to changes in investment risk is subject to two counterbalancing effects: on one hand, higher risk increases the volatility of future consumption and thus stimulates the accumulation of savings, on the other hand, a more uncertain rate of return reduces the attractiveness of saving since it increases the risk of capital losses. The overall impact is thus ambiguous.

This is exactly shown by our results; higher investment risk has no clear impact on the saving rate. We also tried a variety of different specifications, but stock market volatility remained insignificant.

### iii) Bayesian Framework

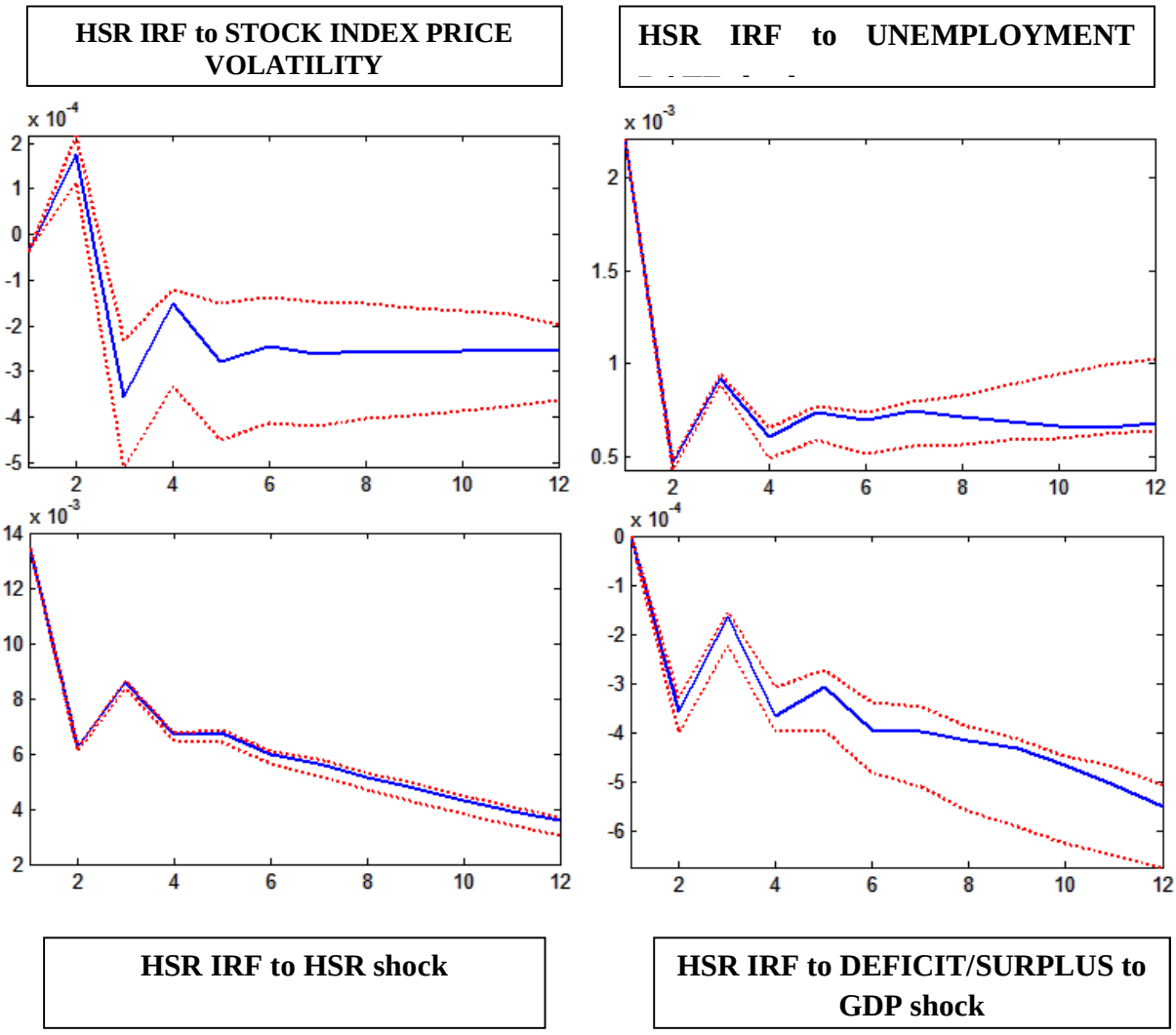
In this section we decided to deepen our study in analyzing the impulse responses due to a shock of each of our variables on the saving rate in aggregate term which means not for each country but for all the countries as an aggregate; the variables which are taken into consideration are: unemployment rate, policy uncertainty, deficit over GDP and debt over GDP.

The problem in running a simple VAR is that our model contains many parameters and a short time series which causes the realization of wide error bands and point estimates which are very sensitive to small changes in sample or model specification.

Given those problems our intention was to apply a Bayesian estimation which implements the Hierarchical Linear Model of Gelman at al. (2003). The reason that leaded us to this choice is that we have few countries and also a moderate size for our time series; Bayesian methods better help to mitigate these two obstacles. This method assumes that slope coefficients are "similar" across countries, meaning that they are not exactly the same across countries but they can slightly diverge among each other's. The idea of similarity is formalized as a Gaussian prior for each country's coefficients, which is centered at a common mean for the region (an exchangeable prior). This prior causes the coefficients to be shrunk towards the common mean. The second stage of the hierarchy consists of the hyperprior about the prior parameters: the common mean and the variance of country coefficients around the common mean (hypervariance). The Hierarchical Linear Model allows to specify the priors in the second stage of the hierarchy as noninformative, and let the data speak about the posterior common mean and hypervariance, given the assumed likelihood and prior structure. Intuitively, more different and more tightly estimated country coefficients increase the posterior probability of large hypervariance values. When country coefficients are more similar, or if they differ but have larger error bounds, hypervariance is more likely to be smaller. Country models which are more tightly estimated receive more weight in the posterior common mean, relative to countries whose estimates are imprecise.[9] Due to time constraints, we couldn't exploit the entire analysis and we just computed Averages Impulse Response Functions of Household Saving Rates to all variables' shocks (Figure 6).

[9] Responses To Monetary Policy Shocks In The East And The West Of Europe A Comparison, *Marek Jarociński, ECB* Working Paper Series No 970 / November 2008

**Figure 6**




Our results are consistent with the SVAR analysis, in particular:

- A decline in the government fiscal balance (increase in the deficit) is associated with higher household savings, possibly capturing Ricardian effects;
- On average Unemployment uncertainty shocks implies higher saving rate on impact, even though the magnitude of the effect in not considerably relevant;

- As expected, impulse response to investment risk or financial Uncertainty is not significant given that single country analysis showed no variations of Household saving rates.

# III. Conclusion

In this paper we analyzed the impulse response on household saving rate on three main sources of economic uncertainty. We observed UK and France household saving rate react the most to all the shocks relative to the other countries that we have taken into consideration. Italy responses significantly only for the unemployment rate because it is considered to be a risk averse country that prefers to smooth consumption over time. On the other hand we have some countries like Germany where saving rate doesn't look to react to any of the shocks. In Portugal and Finland the household saving rate is reacting only to debt and unemployment rate shock. These results suggest that when considering all the shocks, income uncertainty has strong impact on household savings. However these results are not completely satisfactory, that is the reason why the model can be extended by using a Bayesian estimation method which can give more significant results. This method allows us to overcome the problem of having a model with many parameters, few countries and limited time series. We wanted to implement a Hierarchical Linear Model to exploit cross-regions and cross-countries comparison, however due to time constraints we just estimate the Average Impulse Response Functions for Household Saving Rate across all countries.

We intend to extend our model in the future by defining a theoretical model that could explain our assumptions to carry out the identification of structural shocks and enlarging the Hierarchical Linear Model analysis, since the Bayesian Methods would improve the estimation. In addition, it would be interesting to focus on the behavior of Precautionary Savings rather than Saving Rate, in order to analyze the «excess of saving» driven by Economic Uncertainty.

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