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“Effects of Uncertainty on Household Saving Rate”

SUPERVISOR

Prof. Antonio Acconcia

CANDIDATE

Dr. Maria Carannante

Ph.D. COORDINATOR

Prof. Antonio Acconcia

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Abstract

This PhD thesis attempts to investigate the role of economic uncertainty in driving the behaviour of household savings for six European countries. Focusing on three main sources of economic uncertainty Unemployment Risk, Fiscal Policy Uncertainty and Financial Crisis-Investment risk, I construct a Structural Vector Autoregressive (SVAR) model comprising of the Household Saving Rate, main variable of interest; the unemployment rate, to proxy labour income uncertainty and the risk of an income loss; the volatility of financial stock prices per each country, to detect for the presence of financial uncertainty/crisis; a policy uncertainty indicator, using alternatively the Policy Uncertainty Index devised by Baker, Bloom, and Davis (2012), the Debt to GDP ratio or the Government Surplus/Deficit to GDP ratio. A comparison among country-specific cumulative impulse response functions suggests that:

1. Household saving rate's response to a change in investment risk is ambiguous, due to two counterbalancing effects: higher risk increases the volatility of future consumption and thus stimulates the accumulation of savings, while a more uncertain rate of return reduces the attractiveness of saving since it increases the risk of capital losses.
2. A labour uncertainty shock is detrimental or a booster for saving depending on whether the downward pressures on saving rate due to lower saving from unemployed people, prevails or not over the higher households propensity to save for precautionary reasons.
3. Fiscal policy instruments and related uncertainty influence the savings pattern of the private sector: private saving falls when governments reduce deficits (or the debt level) or run large budget surpluses and vice versa, as suggested by the Ricardian paradigm.

I then propose another possible approach to the analysis, a Bayesian estimation of the reduced form VARs for the panel of European countries, as a Hierarchical Linear Model, with the future aim of improving estimation results.

Keywords: Household Saving Behaviour, Policy Uncertainty, Structural VAR, Uncertainty.

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1. 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.

Household choice between saving and immediate consumption depends also crucially on the future uncertainty.

This thesis seeks to investigate the role of economic uncertainty in driving the behaviour of household savings for six European countries: Finland, France, Germany, Italy, Portugal and United Kingdom (UK).

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. In particular, as economic shocks result usually from normal business cycles, financial frictions, and economic restructuring, due to such shocks, households can 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. Moreover, during the recent financial crisis (2007-9), and the subsequent debt crisis in Europe (2009-11), fiscal austerity measures have been introduced by most national governments in order to tackle the outstanding sovereign debt. Fiscal policy measures and related uncertainty may also affect household consumption and saving decision, particularly in periods of financial and economic crisis, as well as any sort of financial crisis resulting in recession has a significant impact on household savings. Financial and economic crisis lead to unemployment in the economy, as a result future income and labour uncertainty obviously would affect household saving decisions. Whenever significant portion of households are affected by the future uncertainty of losing job this often translates into deficiency in demand and consumption which can furthermore lead to economic downturn.

For the reasons mentioned above, I decide to focus the analysis on three main sources of economic uncertainty:

1. Unemployment risk: an increase in labour 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 and the Precautionary saving theory, private sector savings adjust in response to public sector deficits and surpluses, tax policies so as to any source of uncertainty specifically related to actions by policy makers.

The core empirical framework of this thesis is a Structural Vector Autoregressive Analysis (SVAR), particularly useful to serve the purpose of the research and to investigate the impact of shocks to the above mention sources of uncertainty on household savings rate, for each country. Estimation of the country-specific impulse responses allows to compare how household behave in response to such shocks in each economy, hence to observe if saving rate display equal or opposite reactions.

This research thesis relates to at least three literatures, presented in Section 2: the first concerns theoretical and empirical research on saving; the second refers to studies on the impact of uncertainty on economic activity; and third there is a literature focused explicitly on policy uncertainty.

The rest of the thesis is structured as follows: Section 3 provides a brief description of the variables and the data, it includes the SVAR empirical analysis and the empirical results discussion; Section 4 presents an alternative approach to the analysis, a Bayesian estimation of the reduced form VARs for the panel of countries, as a Hierarchical Linear Model; Section 5 concludes and offers some thoughts about directions for future research.

2. THE EXISTING LITERATURE

2.1 The literature on savings

The entire modern theoretical research on consumption and saving grounds its foundations on two dominant models: the permanent-income hypothesis (PIH), focused on a representative infinitely lived consumers, and the life-cycle hypothesis (LCH), overlapping generations models.

Moving away from the preceding Keynesian hypothesis (KH), in which consumption is determined by current income, the PIH takes into consideration a representative, infinitely-lived consumer who relates consumption to permanent income¹ – the discounted value of the sum of non-human assets and human capital – net of the present value of taxes². According to the Ricardian-equivalence hypothesis (REH), permanent income can be computed as net of the discounted value of government spending, by making use of the representative consumer's and the government's budget constraints, which are linked by tax payments³. If a large number of underlying stringent conditions are satisfied⁴, the REH predicts that an increase in permanent government consumption is totally offset by lower private consumption.

However, the homogeneity assumption underlying the PIH is explicitly in contrast with the observed consumer heterogeneity along several dimensions, such as age, income, access to borrowing, etc. This leads to the LCH, which introduces age-related consumer heterogeneity⁵. LCH presumes that individuals base consumption on a constant percentage of their anticipated life income. Intertemporal consumption smoothing is achieved by saving when income is high and dissaving when income is low⁶: aggregate saving reflects the sum of saving by different age specific and finitely-lived cohorts who save for their old-age while working (when they are young), and dissave during retirement, assets are entirely exhausted at death hence agents do not leave bequests.

Nevertheless, several of the key assumptions and predictions of these two basic models are not supported by empirical evidence:

¹ The forward looking PIH consumer distinguishes between temporary and permanent income.

² Friedman 1957, Hall 1978 and Flavin 1981.

³ Barro, 1974.

⁴ An enormous amount of research has been devoted to trying to determine how much truth there is to Ricardian equivalence: the conditions underlying Ricardian equivalence are clearly too restrictive, so it is useful to understand whether it holds as an approximation in the real world or it is too far from it. There are, of course, many reasons that Ricardian equivalence does not hold exactly. The important question, however, is whether there are large departures from it.

⁵ Modigliani and Brumberg 1954; Attanasio and Weber 2010.

⁶ Over the life cycle saving and consumption follow hump shaped patterns.

- An important implication of the PIH is that change in consumption should be unpredictable, hence uncorrelated with any information known to consumers. However many empirical analysis show that the sensitivity of consumption to changes in current income is far greater than what the PIH and LCH would suggest, this is also known as “excess sensitivity” of consumption, i.e., its change is correlated with predictable changes in other variables⁷. This is partly explained by the presence of durable goods⁸, consumption habits⁹, or consumer time inconsistency reflected in hyperbolic discounting¹⁰;
- Another statement is the following: despite of the prediction that individuals decumulate and exhaust their wealth during retirement, it appears that the savings rates of elderly consumers are not significantly lower than those of working-age consumers, hence the elderly do not decumulate assets, or do so only slowly, transferring significant amounts of wealth to their offspring¹¹. Planned bequests are empirically large and sensitive to income levels, implying elasticities of consumption to permanent income significantly lower than one.

The failures associated to deterministic version of the PIH-REH and LCH can be in part explained by the uncertainty theory. Some richer versions of the LCH allow for liquidity constraints and for imperfect markets insurance. In these models risk-averse consumers¹² precautionary save in response to classical uncertainty or risk about future realizations of stochastic variables¹³ (such as the length of life, earnings, medical expenses, or any other consumption determinant), people raise saving beyond the level predicted by the standard PIH or LCH models without uncertainty and tend to die with positive wealth that is bequeathed to the next generation¹⁴.

When risk-averse consumers face additional Knightian uncertainty¹⁵, precautionary saving is raised further¹⁶.

⁷ Typically contemporaneous or lagged income changes.

⁸ Caballero, 1991.

⁹ External Habit, Abel 1990 or Internal Habits Ferson and Constantinides, 1991.

¹⁰ Laibson, 1997.

¹¹ Carroll and Summers 1991; Kotlikoff 1988; Weil 1994.

¹² Skinner, 1988; Zeldes, 1989.

¹³ But not about distributions of stochastic variables, which are assumed to be known and stationary.

¹⁴ In particular, uncertainty about time of death tends to increase savings during retirement since the elderly do not want to exhaust their wealth before they die (Davies 1981). Continuing saving (or lack of dissaving) during the retirement phase of the life cycle may also reflect the working of an explicit bequest motive and life planning for it.

¹⁵ In economics, Knightian uncertainty is risk that is immeasurable, not possible to calculate (i.e., distributions of stochastic variables are unknown). Knightian uncertainty is named after University of Chicago economist Frank Knight (1885–1972), who distinguished risk and uncertainty in his work *Risk, Uncertainty, and Profit*.

¹⁶ Miao, 2004; Hansen and Sargent, 2010.

Other models modify several key assumptions of the PIH-REH and LCH to derive behavioural predictions that are more consistent with the data. There are models introducing borrowing constraints, given that the assumption of perfect capital markets does not hold¹⁷ and households face limits on their ability to borrow against future resources. Due to boundary conditions, consumers opt for corner solutions and borrowers' consumption becomes more sensitive to the amount of credit available and current income than to interest rates and wealth. In models combining precautionary saving and borrowing constraints, forward-looking, risk-averse consumers incur in buffer-stock saving, because they anticipate even tighter future borrowing constraints¹⁸. Consumers accumulate assets during good times in order to buffer consumption in bad times, when they will be unable to borrow from financial markets.

Another crucial feature of the PIH and LCH models is that intertemporal consumption substitution between any two periods is independent of what happens in any other period. Consumption habit models remove this assumption, allowing for intertemporal dependencies by specifying consumer utility in any given period as a function of both consumption and a "stock" of consumption habits. Several models distinguish between internal or external habit formation, however in both cases habits imply that future consumption changes are partly predictable, because they reflect in part past consumption changes, that is consistent with the excess of sensitivity empirical evidence.

An alternative preference hypothesis is that both consumption and wealth (or capital) are valued by consumers¹⁹, i.e., they are gross substitutes in the consumer's utility function. In this model wealth is accumulated for its own sake, and higher wealth prompts further accumulation of wealth and does not raise consumption. This contradicts the PIH-REH and the LCH findings.

The above mentioned literature on household saving points to a number of potential important long-term determinants of the aggregate household savings rate. The former variables are listed below, accompanied by a brief discussion on their impact on saving:

- a. **Income:** it consists of a permanent (anticipated and planned) component and a transitory (unexpected) component. According to PIH and LCH permanent income should be consumed while temporary should be saved. Also models with consumption habits predict that current income should be largely saved. However when the

¹⁷ According to Stiglitz and Weiss 1981 interest rates on loans are not expected to increase in order to clear financial markets because they raise default risks.

¹⁸ Schechtman, 1976, Bewley 1977, Schechtman and Escudero 1977, Deaton 1991b, 1992.

¹⁹ An idea advanced in different ways by "classical" economists from Smith and Marx to Keynes and Schumpeter, and that is resurfacing in recent literature (Cole, Mailath and Postlewaite 1992, Fershtman and Weiss 1993, Zou 1993).

fundamental assumptions of both theories are not satisfied or consumption habits are weak, current income might raise consumption, if it implies borrowing-constrained consumers, or consumption level close to the subsistence income level, or when it signals higher future income. In these cases marginal consumption of current income is high and marginal save is low.

- b. **Wealth:** it comprises net financial assets, real assets and human wealth. Empirical studies generally support the view that wealth is an important variable in explaining long-run movements in household saving, however the sign of the wealth effect is not univocal: higher wealth leads to higher consumption according to the PIH but lowers consumption if wealth and consumption are substitutes in utility.
- c. **Rates of return:** the net result of a change in the real rate of return²⁰ is also ambiguous because of offsetting income, substitution and human-wealth effects. The direction of the income effect depends on whether the consumer is a net lender or borrower. If the consumer is a net holder of financial assets, hence a net creditor, he receives more in investment income than he needs to pay back his debt, so a higher interest rate increases net investment income encouraging present consumption and reducing saving need to finance future consumption. Given that present and future consumptions are normal goods, an higher interest rate might increase present consumption, while smaller savings will grow to a larger amount of future consumption. For net lenders the overall direct effect of higher interest rate on savings is ambiguous, since income and substitution effects have opposite signs, being the first negative whilst the second positive. The real interest rate has also an indirect effect on savings, acting as follows: an interest rate rise results in a fall in non-human wealth, due to the decline in the real value of financial assets (on which the interest rate is fixed for several years) and through lower equity prices (equity flows do not rise proportionately with real interest rate variations). Higher interest rates also results in lower human wealth as the expected discounted value of current and future after –tax labour income and public sector transfers falls with an increase in the interest rate.
- d. **Relative prices and Inflation:** relative prices of consumption affect saving throughout several channels. Higher current consumer price inflation increases current prices of consumer goods relative to past prices, inducing higher saving. Moreover, current

²⁰ A change in the opportunity cost of consumption in the current period.

inflation signals macroeconomic instability, raising precautionary saving. However, higher expected future inflation lead to a lower the ex-ante real interest rate, involving intertemporal substitution, income, and human-wealth effects that cause an overall ambiguous effect on saving by savers with positive net financial asset positions²¹. When referring to the terms of trade, an improvement of the former implies a direct increase in net income from abroad, leading to proportional positive effect on consumers' income. Higher terms of trade reduce the average consumption deflator, given the typical larger fraction of imported goods in the composition of consumption than the exportable ones. Therefore, higher current terms of trade are expected to affect saving positively. For consumption decisions, the real exchange rate is a relative price between different categories of consumption spending. A change in the current real exchange rate, as well as an expected future appreciation, has an ambiguous effect on the consumption deflator, depending on the consumption basket, and therefore on saving.

- e. **Risk and uncertainty:** the effect of risk and uncertainty on saving is ambiguous. According to the precautionary saving theory, higher levels of classical and knightian uncertainty lead to higher precautionary saving, in other terms, higher financial risk measured by larger variance of asset returns or by larger market volatility indicators should brought to higher saving; however, when market volatility is extreme or financial, macroeconomic, and political forms of instability turn into crises, individuals lose confidence in those financial instruments and also in the institutions that issue or back them, as a response saving would decline.

- f. **Borrowing constraints:** in a perfect capital markets environment, tighter current borrowing constraints imply less access by consumers to credit, and therefore increase saving²². This effect is magnified when tighter future constraints are anticipated by risk-averse consumers, giving rise to buffer-stock savings. In other terms, the inability to borrow when times are bad provides an additional motive for accumulating assets when times are good, even for impatient consumers. Proxies of domestic borrowing constraints consist of money and credit flows in addition to current income, whereas a proxy of foreign borrowing constraints is foreign saving or the current account deficit, which is a valid saving determinant when the country faces a binding quantitative

²¹ Whilst a positive effect on saving by savers with positive net financial asset positions.

²² De Gregorio 1993; Jappelli and Pagano 1994.

restriction in its access to foreign funding. In the absence of such a quantitative constraint the sovereign debt premium can reflect the cost of external borrowing being an important component of the cost of foreign funding and therefore it can affect saving like any lending interest rate that affects a debtor, i.e., positively.

- g. **Demographics:** according to the basic LCH the age distribution of households has an effect on the aggregate personal savings rate because the saving rates of individuals are assumed to vary with their age. In particular, the LCH predicts a hump-shaped pattern of saving along the life cycle: an increase in the proportion of elderly households in the population, as well as an increase in the pre-working age proportion is expected to reduce the aggregate saving rate, respectively because pensioners are assumed to dissave, or at least save less than the working households, and parents are expected to spend a large amount of income to satisfy their children needs. Most empirical studies using aggregate macro data have found that increase in the proportions of both the youth and the elderly in the population decrease personal savings rate supporting the predictions of the life cycle model.
- h. **Fiscal Balances and Government Spending:** according to the Ricardian paradigm, given rational and forward-looking consumers, an increase in public sector saving has a detrimental effect on private saving and vice versa. However Ricardian equivalence holds only if a number of stringent conditions are satisfied: absence of liquidity constraints, altruistic motivation in leaving bequest to future generations, etc.. The most widely accepted view is that the RHI prediction of full offsetting is unlikely, indeed not supported by the empirical evidence, but it is expected that a higher government balance lowers private saving. Government consumption has an ambiguous effect on saving, depending if public and private consumption are substitutes or complements in consumer utility²³: when public spending, in categories like education, health, etc., is increased, it reduces private consumption whenever these public categories are substitutes of similar private consumption categories, hence private saving rises. However, government “money transfers” to consumers raise disposable income having an ambiguous effect on private saving rates. Moreover, government social spending and transfers lower uncertainty faced by consumers, reducing the need for precautionary saving. Thus, the overall effect on private saving is ambiguous.

²³ López et al., 2000.

- i. **Pension system:** household savings are affected in a different way according to the pension scheme implemented. Pension benefits financed on a pay-as-you-go basis raise pensioners' consumption either fully or less than fully, having an ambiguous effect on private saving. Two main effects are identified: a "wealth effect" inducing consumers to reduce their saving if the present value of pensions exceeds the present value of contributions and an "induced retirement effect" that causes individuals to increase private saving while working in order to maintain a smoothed consumption during their retirement period. Mandatory contributions to a fully-funded pension system reduce voluntary saving of contributors, but usually not one to one, hence, overall private saving is either maintained or increased. Fully-funded pension system assets held by individuals have an ambiguous effect on saving, like wealth and any of its components as discussed above.

2.2 The literature about uncertainty and economic activity

During the 2007-2008 global financial crisis, the world economy experienced a severe and synchronized contraction in economic activity and an exceptional increase in macroeconomic and financial uncertainty-volatility. The event has relighted academic interest in quantifying the impact of uncertainty on macroeconomic dynamics. Theoretical discussion of what impact uncertainty has on the economy goes back more than 50 years but even today the argument understanding is challenging and not exhausted.

Frank Knight was the first in 1921 to define uncertainty as the condition under which the future is unknown to the extent that people are unable to assign probabilities to events happening. It is often compared to, and sometimes confused with, risk defined as the state in which people are able to assign probabilities to known future events. As by definition uncertainty is difficult to quantify since it cannot be directly observed. Various indices and measures have been proposed in the empirical literature that can be classified into various classes:

- Uncertainty is often defined in terms of financial uncertainty: for example the VIX index²⁴, also known as the fear index on financial markets, is the most widely used measure to assess the effects of uncertainty shocks directly related to financial markets or indirectly to macro-environment connected to financial developments;

²⁴ This index is a measure of the implied volatility of the S&P 500 index options.

- Other measures are based on macroeconomic information: Scotti in 2013 develops a macroeconomic uncertainty index that reflects the agents' uncertainty about the current state of the economy (defined as a weighted average of squared news surprises); Jurado et al. (2014) calculate an uncertainty index from the unpredictable component of a large set of macroeconomic and financial variables; Rossi and Sekhposyan (2015) instead measure uncertainty from the distance between the realized value of a variable and its unconditional forecast error distribution²⁵.
- Uncertainty can also be measured from the disagreement among forecasters on some macroeconomic variables²⁶. This is what Bachmann et al. (2013) have done in order to measure U.S. uncertainty, by looking at the forecast disagreement from the Philadelphia Federal Reserve Business Outlook Survey.
- Uncertainty can also be estimated from news-based metrics. The most representative indices are those of Baker et al. (2013) like the daily news index (built using the number of articles that contain at least one word from sets of subjects, related to the economy, uncertainty and legislation implemented by the U.S. government) or the monthly EPU, economy policy uncertainty (constructed starting from news coverage about policy-related economic uncertainty).
- Another idea is to directly focus on policy uncertainty as computed by the number of temporary tax measures, given the underlying idea that consumers and companies are affected by such uncertainty in their decisions to consume or invest²⁷.

Starting from these different uncertainty measures, some authors have proposed composite indices computed as a weighted average of various components.

As uncertainty can take many forms and can be evaluated in different ways, it is not surprising that empirically studying its effects is also challenging. Standard macroeconomic theory suggests that an increase in uncertainty may cause a temporary fall in economic activity, in particular five principal channels have emerged that describe how uncertainty might affect the economy:

²⁵ Interestingly, Rossi and Sekhposyan 2015 compare the responses of employment and industrial production to an uncertainty shock using alternatively the uncertainty measure from the papers of Baker et al. 2013, Jurado et al. 2014, and Scotti 2013. They find significantly different quantitative responses depending on the uncertainty measures used, the uncertainty measure from Jurado et al. 2014 generating the most negative responses to an uncertainty shock. The rationale for these different responses is that the uncertainty measure from Scotti 2013 only refers to real economic activity uncertainty, whereas Jurado et al. 2014 measure uncertainty from a larger set of variables including both macroeconomic and financial (bond and stock market indices) variables thereby generating stronger responses from uncertainty shocks.

²⁶ This approach consists in evaluating the cross-sectional dispersion of conditional forecasts from a panel of economists.

²⁷ Baker et al. , 2013.

- The OiHartman-Abel effect: uncertainty increases investment of competitive, risk neutral firms;
- Real-options effects: uncertainty can make firms cautious about hiring and investing ;
- Financing costs: Uncertainty can increase risk premia ;
- Precautionary savings: Uncertainty can reduce consumption spending;
- Growth option effect: uncertainty can encourage investment by expanding the upside of future outcomes.

Oi (1961) and Hartman (1972), later followed by Abel (1983), argued that uncertainty actually increases investment of competitive, risk neutral firms. The intuition they provided is that firms can expand to exploit good outcomes and contract to insure against bad outcomes, making them potentially risk loving (exploiting upside potential of uncertainty whilst insuring against bad outcomes). However, for this effect to apply, firms need to be flexible and quickly adjust (i.e. expand or contract) in response to good or bad news²⁸. In the real world, the so-called “Oi-Hartman-Abel” usually is not very strong in the short-run (because of adjustment costs) while in the medium and long-run it can be more powerful (Bloom, 2013).

The largest body of theoretical literature focuses on real-options, which goes back to Bernanke (1983), Brennan and Schwartz (1985), McDonald and Siegel (1986), and Dixit and Pindyck (1994): in an uncertain policy environment, firms facing irreversible, costly decisions are better off waiting for more predictable conditions. Hence, irreversible investment, due to the presence of adjustment costs²⁹, is the mechanism through which shock in uncertainty will negatively affect economic activity: exogenous changes in volatility lead to the postponement of irreversible investment and hence a fall in the current level of economic activity, but as uncertainty is resolved, investment plans are brought forward and the level of economic activity begins to recover.

Another channel by which uncertainty can reduce growth is through increasing risk premia, contingent to the interplay between uncertainty and financial friction. As James Tobin pointed out investors want to be compensated for higher risk, and as uncertainty rises this should raise the cost of finance. To the extent that investors are diversified it will be the systemic (rather

²⁸ In other words, it only applies to firms with low fixed costs (Caballero and Leahy, 1996).

²⁹ The literature distinguishes two families of adjustment costs. There are lumpy “non-convex” adjustments costs, which are fixed-costs (a one-off cost to buy/sell capital) and partial irreversibility (a cost per unit of capital sold). These “non-convex” adjustment costs generate real options effects. There are also smooth “convex” adjustment costs like quadratic adjustment costs (a cost that increases in the squared rate of investment), which do not generate real options.

than idiosyncratic) component of uncertainty that will raise financing costs. Gilchrist, Sims and Zakrasjek (2010), for example, argue that uncertainty increases firms' left-tail risk and thereby raises borrowing costs as lenders demand higher interest rates, which means a greater "risk premium". The less favourable credit conditions in turn lead to more persistent declines in overall investment activity relative to times of "normal" uncertainty, burdening the aggregate economy. Similarly, Arellano, Bai and Kehoe (2010) report that, under heightened uncertainty, firms decrease the size of their investment projects in order to reduce the risk of bankruptcy, hence investment persistently decline. Narita (2011) argues that firms with agency problems are more likely to default in uncertain times and that because surviving units will have less risk appetite and, on average, also produce lower returns, an uncertainty shock will lead to an intensifying and persistent decline in economic activity. Other researchers claim that high uncertainty is merely a by-product of bad economic times. Bachmann and Moscarini (2011), for example, argue that uncertainty increases as a result of first moment shocks (i.e. mean declines) in output because firms then need to "review their modus operandi and to change their strategy to survive."

The fourth major channel for uncertainty to impact economic activity is through precautionary saving, which itself reduces consumption expenditure³⁰. In response to higher uncertainty consumers precautionary save, this can potentially increase long-run growth by encouraging investment, however in most open economies some of this increased saving will leave the country and be invested abroad, reducing domestic demand. Fernandez-Villaverde et al. (2011) emphasized this mechanism, arguing that higher uncertainty can be detrimental for growth in small and open economies, like Argentina and Ecuador, leading domestic savers to move money abroad, hence reducing local investment. The impact of this risk channel is less clear for larger and more closed countries, like the US. When considering a closed economy, higher uncertainty leads consumers to increase their savings, interest rates becomes lower, while investment rates rise. Therefore higher uncertainty would reduce consumption and simultaneously increase investment. This seems wrong since uncertainty is usually harmful for growth rather than beneficial for investment boost. This counterintuitive aspect does not occur when considering new Keynesian models with sticky prices: uncertainty shocks cut both consumption and investment, since prices do not fall enough to clear markets³¹. In those models and a related paper by Fernandez-Villaverde et al. (2013) uncertainty is particularly damaging if other policy tools – like interest rates - are ineffective, because interest rates are constrained at zero.

³⁰ Bansal and Yaron , 2004.

³¹ Leduc and Liu 2012, and Basu and Bundick 2013.

Uncertainty can potentially have a positive impact on the economy through the so called “good news principle” or “growth options”, encouraging investment by increasing the size of the “good outcome” prize. Bar-Ilan and Strange (1996) noted that if firms have long delays in carrying out their projects then uncertainty have a positive effect on investment. Growth options were indeed involved in explaining the dot-com bubble of the late 1990s: new website makers were unsure about the internet, but that extreme uncertainty encouraged investment because the worst outcome for those firms was somehow bounded, consisting in closing the project and losing their development costs, while the best outcome was dependent on the success of the internet which increased with uncertainty. Developing websites took time, that is why it was seen as investing in a “call-option” on the future success of internet.

Empirically studying the effects of uncertainty is challenging, as a consequence, the methodologies used in the literature and the results are varied. As outlined by Bloom (2013), an early example of a classic empirical macroeconomic study is that by Ramney and Ramney (1995), who use a measure of volatility in government spending to proxy for uncertainty and find a strong negative association of the latter with growth in cross country regressions. Subsequent studies support this finding that volatility negatively impacts growth, using more advanced estimation techniques (Engel and Rangel, 2008) and other uncertainty proxies, such as natural disasters, terrorist attacks and political shocks (Baker and Bloom, 2013). Further research has reported also a negative association between uncertainty and other macroeconomic variables, such as investment, employment, consumption, and trade:

- Romer (1990) finds that events of extreme uncertainty, such as the stock market crash in October 1929, usually depress consumption almost as much as investment;
- Bloom (2009) measures the impact of time-varying uncertainty on investment and employment and shows that uncertainty shocks generate a wait-and-see effect;
- Novy and Taylor (2012) study uncertainty shocks in an international context and find that they lead to significant contractions in trade³².

There are also a number of empirical study on the effects of uncertainty that use micro data. Leahy and Whited (1995), for example, report a strong negative linkage between firm-level investment of US listed companies and uncertainty measured in terms of stock-market volatility. On the same line, Guiso and Parigi (1999) show a negative relationship between Italian firm-level investment and uncertainty, which they proxy by quantifying the extent of dispersion in Italian CEOs’ future demand forecasts.

³² Handley and Limão 2012 confirm this link after finding that Portugal’s 1986 preferential trade agreement with the European Community increased trade to a large extent because uncertainty over trade declined.

More recently, both in policy making and academia, uncertainty has been regarded as one of the major factors that intensified the financial crisis and prolonged its recovery (Baker et al., 2013). This view encouraged more innovative empirical research on measuring uncertainty, its interplay with financial frictions (e.g. Christiano, Motto and Rostagno, 2009) and its general economic impact. Alexopoulos and Cohen (2009) use a narrative approach³³ in a structural VAR framework, quantifying the frequency of key words like “uncertainty or uncertain” and “economy or economic” in New York Times articles, and find that uncertainty shocks might explain about 10-25 percent of the variations in the US business cycle, causing short-run declines in output, consumption, employment, and investment. Leduc and Liu (2013) find that uncertainty shocks produce the same effects than a negative aggregate demand shock based on both VAR and DSGE models. Caggiano et al. (2014) suggest the effects of uncertainty shocks vary over the state of the business cycle, providing evidence for a stronger effect of uncertainty shocks in recessions than expansions. Many other research works find a significant negative relationship between uncertainty and economic activity, however recently some contradictory evidence has appeared. For example, Bachman et al. (2012), who study the impact of uncertainty in both the US and in Germany, not only find that the response in production to uncertainty is quite small but also that it differs qualitatively and quantitatively between the two countries: evidence in Germany partially support the wait-and-see effect, while in the US, more persistent declines in production suggest the presence of financial frictions. The difference has been motivated by the stronger labour market regulations in Germany, which involve higher hiring and firing costs. The researchers conclude that since the wait-and-see dynamic relies on the assumption of firms facing high fixed costs, it is obvious that evidence for the wait-and-see hypothesis is stronger for Germany.

Joets et al. (2015) is one of the most recent empirical papers on the macroeconomic effect of uncertainty. They assess the impact of macroeconomic uncertainty on various raw materials markets and find that some specific markets (e.g. agricultural or industrial markets) are strongly related to the variability or the level of macroeconomic uncertainty³⁴.

Some recent papers also look at the effect of uncertainty on variables related to monetary policy, for example, Istrefi and Piloiu (2014) consider the effects of policy uncertainty on inflation expectations in the U.S. and the euro area. Using a Bayesian VAR model, they show that the effect of a shock in the EPU index differs depending on the horizon of the inflation expectations: while an uncertainty shock tends to decrease short-term inflation expectations (similar to a

³³ On the ground of earlier narrative studies by Romer and Romer (1989, 2004) and other researchers.

³⁴ In addition, they find evidence of non-linearity in this relationship in the sense that its strength depends itself on the degree of uncertainty.

negative impact on output), it leads to an increase in long-term expectations. The authors thus point out the monetary policy trade-off between supporting output and anchoring long-run inflation expectations, in response to uncertainty shocks. Also, Aastveit et al. (2013) look at the effects of uncertainty on monetary policy transmission mechanism and conclude that U.S. monetary policy is less effective during periods of high uncertainty. In particular, the response of investment to monetary policy shocks is much weaker when uncertainty is high.

Concluding, an international comparison on the effects of uncertainty shock is provided in Vu (2015) that performs a cross-country analysis on a panel of OECD countries. In particular, he finds evidence for a short-lived negative response of output and interest rates to unexpected stock market volatility shocks not only during financial crises, but also in normal times.

2.3 The literature about economic policy uncertainty

In the light of the Global Financial Crisis and serial crises in the Eurozone, the role played by economic policy uncertainty in macroeconomic fluctuations has been intensely discussed in academia, policymaking institutions and the financial press. Indeed, the Federal Open Market Committee and the IMF suggest that uncertainty about U.S. and European fiscal, regulatory, and monetary policies contributed to a sharp economic decline in 2008-09 and slow down the recovery.

Economic Policy uncertainty can be defined as uncertainty specifically related to actions by policy makers of both national or international institution in the areas of:

- Monetary Policy (uncertainties about the path of interest rates, the zero-rate bound, effectiveness of extraordinary policy and their unplanned consequences for growth and inflation), Fiscal and Budgetary Policy (uncertainties about future taxes, spending, health care reform, and more generally future policies to tackle the fiscal deficit);
- Industries Regulation (in particular the financial sector);
- Policy related to national security.

Policy-related uncertainty also embraces uncertainty related to political elections or specific political events, as well as to policy-making authority.

There is a literature focused explicitly on policy uncertainty and several authors in the past years considered the detrimental economic effects of monetary, fiscal, and regulatory policy uncertainty. An early example is Friedman (1968), who addresses a negative effect of

uncertainty concerning central banks' monetary policy, and argues that if central banks pre-specified predictable currency growth, economic stability would increase. Rodrik (1991), using a large data set from developing countries, shows that fiscal policy uncertainty (i.e. uncertainty regarding the permanence of reforms) has a negative effect on private investment. Hassett and Metcalf (1999) show that uncertainty about tax policy reduces investment. An innovative approach in measuring economic policy uncertainty is that by Durnev (2010) and Julio and Yook (2010) who study the relation between policy uncertainty and corporate investment by using election years as indicators of times of high political uncertainty. Durnev (2010) finds that corporate investment is not significantly lower in election years compared to in non-election years, Julio and Yook's (2010) instead suggest a significant negative relationship between political uncertainty and investment activities³⁵. Regarding this latter finding, Higgs (1997), already, emphasises that the US regime change in 1945 from Roosevelt to Truman causes an investment boom as Roosevelt's administration was considered "full of uncertainty" over regulatory policies.

Research on policy-related uncertainty is limited in this earlier period especially because uncertainty specific to economic policy is not so easily measured compared to general uncertainty (i.e. proxied with stock market volatility or forecast discrepancies).

With Baker, Bloom and Davis (2012) the literature on EPU reached an important turning point. The researchers use a combination of data on tax code expirations, forecast disagreement measures, and a measure of the frequency with which several uncertainty-related key words appear in a large archive of newspaper articles³⁶. The authors find three preliminary results: policy uncertainty fluctuates over time and since 2008 has reached all-time levels; policy uncertainty is now large (and probably the largest) driver of overall economic uncertainty; policy uncertainty appears to lower economic growth and raise stock market volatility.

Using VARs, Baker et al. (2013) find that the increase in US EPU from 2006 to 2011 seems to be associated with a decline in US employment by up to 2.3 million jobs and a dip in industrial production by up to -2.5 percent. Conducting a study with the same data, Stock and Watson (2011) also regard EPU as a likely explanation for the severity of the 2007-2009 US recession.

³⁵ One problem with the dummy-based measure used in both studies is that it does not account for any uncertainty swings during non-election years. Furthermore, not all election years necessarily imply heightened uncertainty.

³⁶ The subcomponents of the index include the following: 1. Newspaper coverage of policy-related economic uncertainty; 2. Number of federal tax code provisions set to expire; 3. Disagreement among economic forecasters on future levels of CPI; and 4. Disagreement among economic forecasters on federal government purchases of goods and services. The weights of the index are 50% on the broad newspaper index and 50% for the three other components.

With the availability of BBD's new data, a small literature has emerged covering the effect of EPU on various variables, such as unemployment dynamics (Caggiano, Castelnuovo, Groshenny, 2013), stock prices (Pastor, Veronesi, 2011a), risk premia (Pastor, Veronesi, 2011b)³⁷, corporate investment (Gulen and Ion, 2012), inflation expectations (Istrefi, Piloiu, 2013), or the effectiveness of monetary policy (Aastveit, Natvik, Sola, 2013). However, evidence of recent empirical studies is less clear on whether or not EPU indeed negatively affects economic activity: Born and Pfeifer (2011), for example, argue that EPU is "unlikely to play a major role."

N. Antonakakis et al. 2012 explore the dynamic co-movements between macroeconomic policy uncertainty and stock market returns using the index of macroeconomic uncertainty by Baker et al. (2012) and identify several empirical regularities: first dynamic correlations between policy uncertainty and stock market returns are consistently negative; in addition, increased stock market volatility increases policy uncertainty and dampens stock market returns, while increases in the volatility of policy uncertainty lead to negative stock market returns and increased uncertainty; finally, oil specific demand shocks and domestic shocks (price and income shocks) lead to further increase in the negative correlation between policy uncertainty and stock market returns.

Mumtaz and Surico (2013), estimate fixed-coefficients VARs with a stochastic volatility specification for the VAR's time-varying covariance matrix of reduced-form innovations in order to explore the macroeconomic impact on the U.S. economy of uncertainty relating to government spending and taxes, debt sustainability, and monetary policy³⁸. Their main result is that the largest impact on real economic activity is associated with uncertainty shocks about debt sustainability, whereas shocks pertaining to the other three types of uncertainty have much smaller effects.

Few academics question the validity of the new measure proposed by Baker, Bloom and Davis' (2012). Brogaard and Detzel (2012) have tried to reinvestigate BBD's EPU measure. Using a different news search engine to extend a similar version of BBD's index across 25 countries, they study the impact of EPU on stock markets, finding that when EPU increases by 1% market returns fall by 2.9% and stock market volatility rises by 18%. However, when constructing their index, the two researchers make an assumption that potentially biases their EPU index: they rely

³⁷ Pastor and Veronesi (2012, 2013) model the theoretical links among fluctuations, policy uncertainty, and stock market volatility.

³⁸ A main feature of Mumtaz and Surico's 2013 empirical specification is that the volatility of policy uncertainty shocks (which are identified based on a recursive scheme) is allowed to have an impact on the VAR's dynamics, thus introducing a link between second and first moments.

on the newspaper database World News Access to automatically translate all international articles into English prior to running their algorithm. This saves time but it ultimately hinders them from correctly attributing uncertainty to specific countries.

Sum (2012), Colombo (2013) and Piano (2013) and Gunnemanna (2014) are the first to focus on economic policy uncertainty in Europe:

- Vichet Sum 2012 examines the impulse response function of economic policy uncertainty (EPU) and stock market returns in the Eurozone. His study shows that Eurozone stock market returns respond positively to the changes in economic policy uncertainty. However, the pooled OLS shows that the increase in the changes in economic policy uncertainty predicts lower stock market returns.
- Colombo (2013) studies reactions in various macro variables to shocks in both US EPU and European EPU and reports that a shock in US EPU has a stronger impact on industrial production in Europe than an equivalent European EPU shock.
- Piano (2013) studies the impact of shocks in aggregate European EPU on industrial production in Germany, France and Italy, reporting evidence in support of the financial frictions hypothesis.
- Closely related to Baker, Bloom and Davis' (2012) American EPU index, Julius Gunnemanna (2014) develops new indices of economic policy uncertainty (EPU) draw on over 60 million newspaper articles and an innovative algorithm for nine European countries then use VARs to study the macroeconomic impact of policy-related uncertainty on industrial production and unemployment across those economies. He finds that positive innovations in economic policy uncertainty appear to have little statistically or economically significant impact on industrial production and unemployment across the various economies. This result is robust to numerous alternative model specifications and to using Baker, Bloom and Davis' (2013) data. Perhaps policy-related uncertainty does not curb the economy as much as we commonly believe.

Finally, an alternative strand of literature has used either calibrated or estimated DSGE models in order to explore the role played by uncertainty shocks in macroeconomic fluctuations. The best-known example of this literature is probably Born and Pfeifer (2014) Fernandez-Villaverde, Guerron-Quintana, Kuester, (2015) study policy uncertainty in DSGE models, and Rubio-Ramirez (2013), who estimate stochastic processes with time-varying volatilities for U.S. government's tax and spending policies, and then feed the estimated processes into a calibrated standard New Keynesian model. Their main finding is that "fiscal volatility shocks can have a sizable adverse effect on economic activity".

3. EMPIRICAL ANALYSIS

3.1 Description of the Dataset

The sample data set comprises quarterly data covering the period 1999-2014 for seven European countries: Finland, France, Germany, Italy, Spain, Portugal and UK. Data have been collected from three main databases: Eurostat, OECD and Bloomberg.

The main variable of interest is household saving rate³⁹: it is calculated dividing gross saving⁴⁰ by gross disposable income, the latter being adjusted for the change in the net equity of households in pension funds reserves⁴¹. 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).⁴²

Caution is needed when comparing household saving rates across countries due to institutional differences and data reliability that can partially invalidate this procedure⁴³.

What can be inferred by the data is that household saving rates differ significantly among EU countries, and those differences are persistent over time. In countries like Germany, France and Belgium, households save a relative large share of their disposable income. Instead, households in Romania and Bulgaria seem to spend more than they earn, showing negative saving rates. Persisting differences across countries can have important implications for the wider economy. Indeed, household saving determines the availability of credit to finance investments, both private and public: insufficient saving might therefore deter investment and dampen economic growth. The discrepancy in household saving rates may suggest that some countries rely more

³⁹ Eurostat statistic.

⁴⁰ The part of gross disposable income that is not spent as final consumption expenditure.

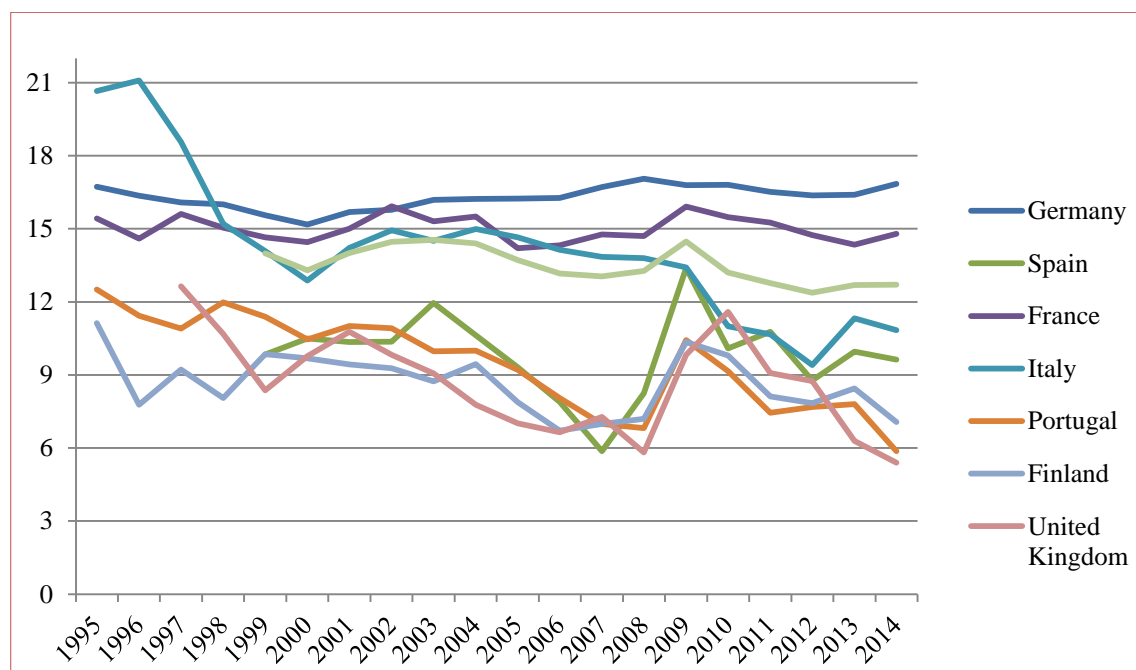
⁴¹ This accounting adjustment is necessary in order to reconcile the household income account with their financial account. National accounts in fact treat contributions to and pensions paid out by pension funds as contributions to and payments from the social security system. This is recorded in the income account. At the same time, changes in pension fund assets of households are also recorded in the financial accounts including their changes in net equity. Consequently, differences in pension systems among countries can reduce the international comparability of saving rates.

⁴² 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.).

⁴³ Even when using highly harmonized data for EU countries, significant differences remain.

on foreign savings to finance domestic investments making these countries more vulnerable to external shocks.

Figure 1 : Household Saving Rate



The Unemployment rate⁴⁴ is used as a proxy for labour income uncertainty and the risk of an income loss: it is defined as the number of unemployed persons expressed as a percentage of the labour force⁴⁵.

Unemployment levels and rates move in a cyclical manner, largely related to the general business cycle. However, other factors such as labour market policies and demographic developments may also influence the short and long-term evolution.

Europe has struggled with persistent structural unemployment for the past two decades. High natural rates of unemployment have been attributed to:

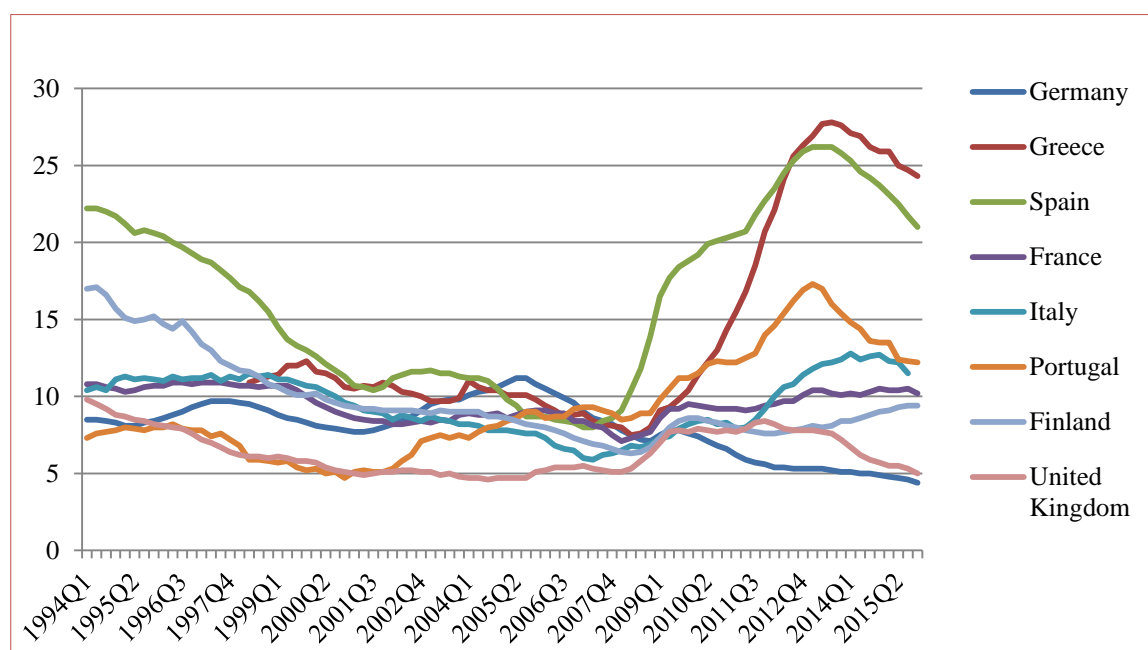
- Inflexible labour markets;
- Generous unemployment benefits which encourage frictional unemployment;
- Geographical immobilities;
- Strong labour market regulations which discourages firms from investing and taking on new workers.

⁴⁴ Bloomberg statistic.

⁴⁵ For statistical purposes, the labour 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.

Figure 2 shows the large heterogeneity of unemployment rates across countries. This heterogeneity has always been present, however after the 2007-2008 financial crisis is more marked, that is why is usually incorrect and misleading to talk about “European unemployment”.

Figure 2 : Unemployment Rate



In the 1990s, average European unemployment remained very high, peaking at 10.4% for the EU15 average in 1993, and ending at 7.6% in 2000 (a cyclical peak). But this average reflected an increasing heterogeneity of evolutions across countries:

- Unemployment remained high in France, Spain, and Italy. Germany’s unemployment rate, which had remained relatively low until the early 1990s, steadily increased after reunification;
- Unemployment decreased to under 5% in the UK, Ireland, and the Netherlands, all from high levels in the early 1990s⁴⁶;
- Unemployment remained relatively low in Austria, Norway, and Portugal. And, while it went up sharply in Sweden, Denmark, and Finland, the behaviour of inflation suggests that this was mostly a cyclical movement— an increase in the actual unemployment rate over the natural rate—and unemployment sharply declined thereafter; of the three countries, only Finland still had high unemployment.

⁴⁶ Belgium, with an unemployment rate of 8%, is an interesting case; the unemployment rate in the Flemish provinces, those close to the Netherlands, is 5%, while the unemployment rate in the Wallon provinces, those close to France, is 11%.

Unemployment has been quite low in many countries in the early 2000s: the United Kingdom, the Netherlands, Denmark, Ireland, and Austria all had unemployment rates lower than the United States. And high average European unemployment reflected high unemployment in the four large continental countries, Germany, France, Italy, and Spain. Even among these four countries, the differences were remarkable.

After three years of steadily declining unemployment, Europe felt the impact of the economic crisis on its labour market. Indeed, after falling to 7.5% in 2008, the prolonged recession of 2008-13, has caused a sharp rise in unemployment. In particular Unemployment has been rising sharply in both the euro area and the EU since March 2008⁴⁷. The increase showed up in every Member State, although each of them faced the onset of rising unemployment at very different points in time and also the severity varied widely between countries and groups⁴⁸:

- In Spain and Italy, unemployment started to rise as early as May 2007. Ireland, Luxembourg, Latvia and Lithuania followed in 2007;
- In France, the rate has increased since February 2008;
- All other Member States have a turning point later than the euro area and the EU. One can make a distinction between two groups. The first one - Estonia, Finland, the United Kingdom, Belgium, Greece, Portugal, Romania, Denmark, Austria and Sweden - started experiencing rising unemployment in the second quarter of 2008. The remaining countries saw unemployment increasing only in the second half of 2008. In Bulgaria, Germany and the Netherlands, rising unemployment rates were recorded starting in November 2008, one and a half years later than in Spain and Italy.

An explanation for this is that Member States structure and regulate their labour markets very differently from one another⁴⁹.

In 2012, economic activity contracted by 0.3% in the EU and by 0.6% in the Euro area, due to financial market fragmentation, debt overhang, and decelerating growth in emerging markets. The unemployment rate in Europe has continued to climb further until early 2013, reaching unprecedented levels in recent history, above 12% and well above the previous peak registered after the 1993 recession. Labour dynamics continued to differ substantially across countries. While employment growth was robust in the Germany employment losses were recorded especially in the Greece, Spain, and Portugal (who still have unemployment rates of over 20%).

⁴⁷ The unemployment rate, rose from 7.2 % in March 2008 to 9.5 % in May 2009 in the euro area. In the same period, the rate in the EU surged from 6.7 % to 8.9 %. The unemployment rate in May 2009 is the highest since May 1999 for the euro area, while for the EU it is the highest since June 2005.

⁴⁸ Men are clearly affected more than women. Young people also appear to be more vulnerable.

⁴⁹ It should be mentioned that for some countries the turning point is much more distinctive than for others, though there are no clear geographical patterns.

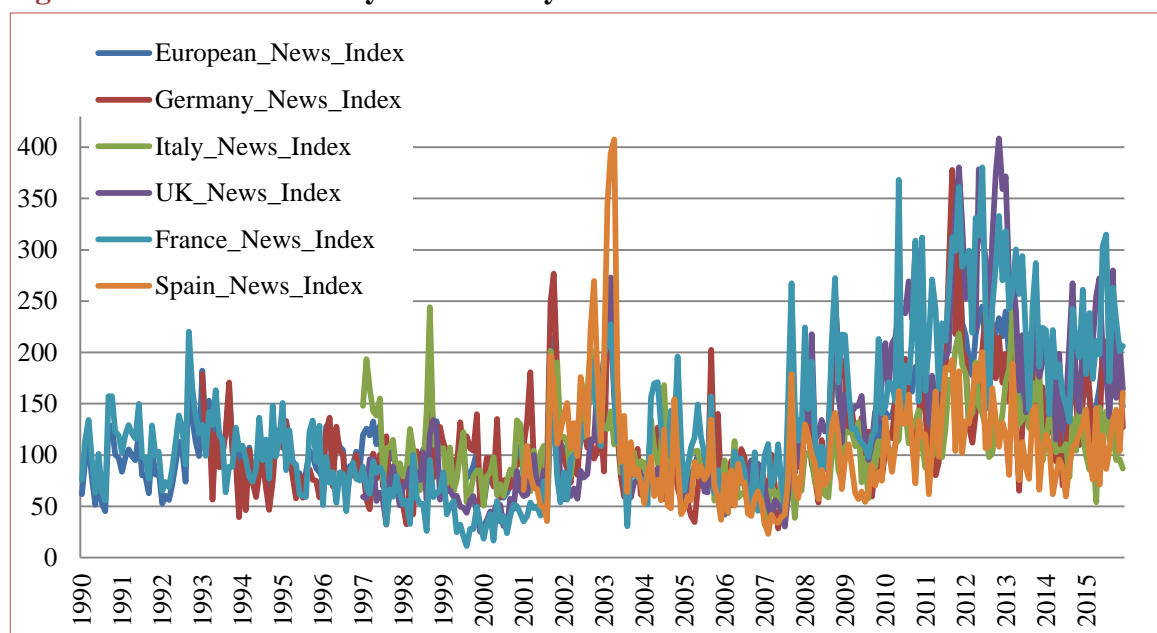
Differences in unemployment dynamics reflected to a large extent GDP growth differences, but a relevant role was played by different responses of employment to economic activity⁵⁰.

Looking at the recent years, the Eurozone's unemployment rates are improving: 23 member states saw unemployment decrease in the past year, and only four recorded an increase. However, although in 2015 there has been this reduction in European unemployment, the prolonged period of mass unemployment is leaving significant social and economic problems for the whole Eurozone.

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

1. Policy Uncertainty Index : I averaged monthly data of economic policy uncertainty from 1999 to 2014 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)⁵¹ revised in September 2015;

Figure 3: Economic Policy Uncertainty Index

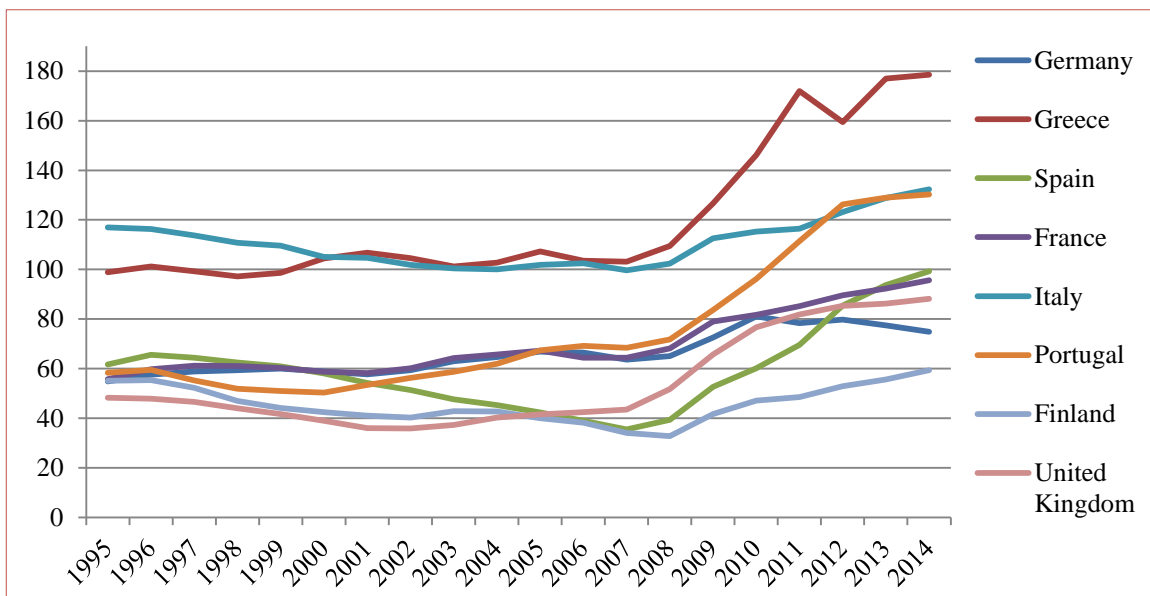


⁵⁰ The employment prospects of the young were especially affected in the crisis in light of the strong sensitivity of youth unemployment to economic activity. By 2012, youth unemployment was above 25% in 13 EU countries, with peaks above 50% in Spain and Greece. Such trends were worrying in light of the impact of protracted unemployment spells for the youth on labour market participation, long-term "scarring effects", and their implications in terms of human capital losses and social cohesion.

⁵¹ To measure European policy-related economic uncertainty, BBD construct an index based on newspaper articles containing the terms uncertain or uncertainty, economic or economy, and one or more policy-relevant terms regarding policy uncertainty. They draw on two newspapers per country for the European indexes: Le Monde and Le Figaro for France, Handelsblatt and Frankfurter Allgemeine Zeitung for Germany, Corriere Della Sera and La Repubblica for Italy, El Mundo and El Pais for Spain, and The Times of London and Financial Times for the United Kingdom. The detailed methodology of how the index is developed can be accessed at <http://www.policyuncertainty.com/methodology.html>

2. Debt to GDP ratio⁵²: 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);

Figure 4: Government Debt as a Percentage of GDP

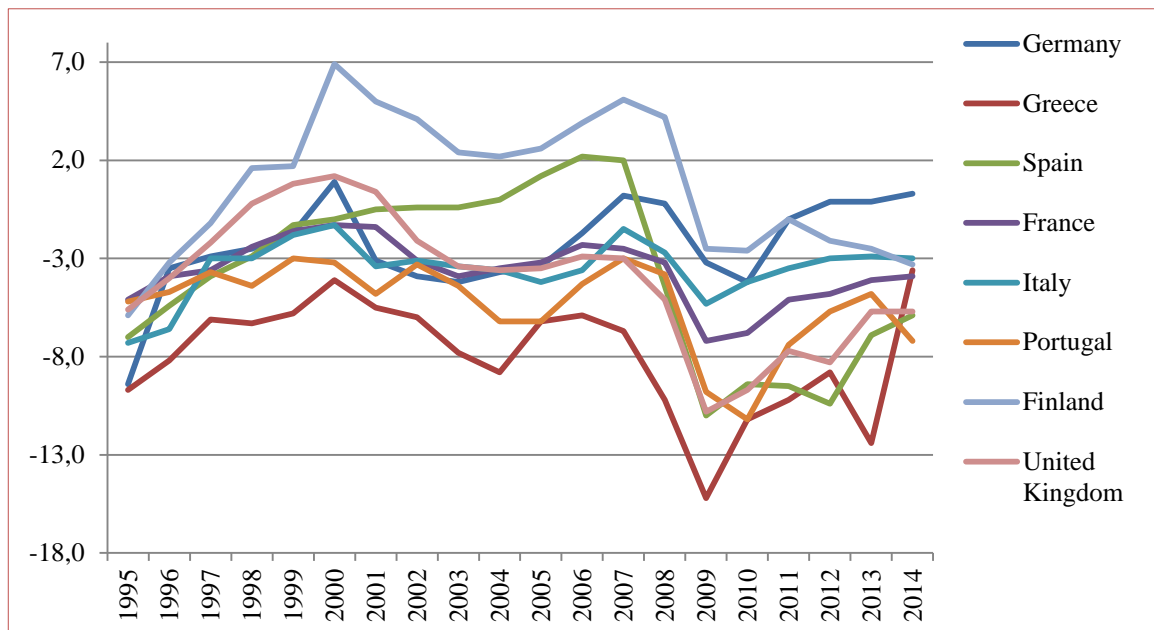


3. Government Surplus / Deficit over GDP⁵³: The general government deficit/surplus is defined in the Maastricht Treaty as general government net borrowing/lending according to the European System of Accounts. It is the difference between the revenue and the expenditure of the general government sector. The series are presented as a percentage of GDP. GDP used as a denominator is the gross domestic product at current market prices.

⁵² Eurostat statistic.

⁵³ Eurostat statistic.

Figure 4: Government Deficit/Surplus as a Percentage of GDP



A short digression on the evolution of Debt in Europe can facilitate the interpretation of the latter graphs.

To prevent excessive budget deficits and the over accumulation of debt, the Maastricht Treaty of 1992 and the Stability and Growth Pact of 1997 introduced rules to stabilize public finances. More specifically, members of the European Union, and especially members of the Eurozone, were required to limit annual public deficits to 3% of GDP and public debt to 60 % of GDP. Since the introduction of this rule-based policy framework, however, not all members have succeeded in achieving fiscal discipline.

The evolution in the public debt levels of selected EU countries is shown in Figure 3. A notable feature is that most countries managed to reduce their level of debt over the first decade of the 2000s. Spain and Ireland in particular have made tremendous efforts to reduce their indebtedness. Although Greece and Italy registered small successes in their debt reduction, they were among those countries with the highest debt levels that entered the monetary union. The two largest countries of the Eurozone, France and Germany, experienced steady increases in their budget deficits and exceeded the Maastricht deficit criteria, which led to a controversy over the temporary suspension of sanctions. In 2009, however, all of the countries in the EU were forced to react to the global financial crisis by increasing their government spending and providing fiscal stimulus, as a result government debt rose to historical levels. High level of government borrowing is likely to raise governments' financing costs, with a possible adverse impact on private financing conditions and a crowding-out of private investment, thus lowering

potential economic growth. Moreover, the sharp increases in government debt ratios have adversely affected the markets' confidence in government liquidity and solvency in several countries. Government debt-to-GDP ratios have continued to increase sharply, also as a direct consequence of economic contractions and counter-cyclical fiscal policies. By 2010, sovereign debt crises, most pronounced in Greece had spread out through Europe and in 2011 the EU and the IMF had bailed out Greece, Ireland, and Portugal. At the end of 2011, the centre of the debt crisis shifted to Europe's larger countries, including Italy, the Eurozone's third largest economy. However, a bailout was not an option for Italy⁵⁴. Spain, like Ireland, faced a housing-market bust that left its banking sector highly exposed and by 2012, it was forced to request a bailout, and EU leaders agreed to use Eurozone funds to recapitalize Spanish banks. By 2014, periphery countries, with the exception of Greece and Cyprus, had completed their bailout programs. In December 2013, Ireland was the first country to exit its program. Spain followed in January 2014, and Portugal too exited in May 2014. After difficult years, by the end of 2014 and during the entire 2015, SIGNS of an economic recovery has showed up⁵⁵, but deep structural problems persist, including persistent high unemployment, weak banking systems, huge debt, and rigid labour markets. Currently, less than half of the EU countries meet the target of debt levels below 60 percent.⁵⁶

Finally, in order to focus on investment risk and related financial market uncertainty, a measure of the stock market volatility has been used. In particular I 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 quarter⁵⁷.

⁵⁴ Instead, then-Prime Minister Silvio Berlusconi was forced to step aside in favour of a new government, led by economist Mario Monti, charged with carrying out budget cuts and reforms to pensions and labour markets.

⁵⁵ Growth in the periphery resumed: Ireland is set to be the fastest growing Eurozone economy in 2015, having expanded 5% in 2014. Portugal is expected to expand 1.5% in 2015, and Spain's economy has been growing since 2013.

⁵⁶ A crucial question is how similar debt levels in the EU countries affect economic activity and growth levels. It is widely accepted, that beyond a certain threshold level, further increases in the level of debt as percentage of GDP lead to lower economic growth. Reinhart and Rogoff (2010) find that for both advanced and emerging countries, high debt/GDP ratios of 90 percent and above are associated with notably lower growth outcomes. For countries in the EU Mencinger, Aristovnik and Verbic (2014) provide evidence that the turning point for new member states is substantially lower than that for old member states. These findings are important for fiscal governance in the Eurozone, as they indicate different levels of economic activity for similar debt levels.

⁵⁷ Financial stock used per each country: Italy MIB 30, German DAX, France CAC40, Portugal PSI 20, Finland HEX 25 and United Kingdom UKX FTSE100.

3.2 SVAR Analysis

Before performing the vector autoregression analysis I checked the unit root for all the series using the Augmented Dickey Fuller test.

For the Unemployment rate series I found unit root and proceeded in differencing the time series. However, I also performed the estimation by keeping unemployment data in level form, attributing the presence of a unit root to the short length of the time series, hence assuming regressors to be stationary in a long run perspective, and also to the inappropriate use of the ADF unit root test.

Numerous theoretical and empirical discussions investigated the behaviour of unemployment and the unit root properties in case of OECD countries on the grounds of two economic theories:

- Hysteresis in unemployment hypothesis developed by Blanchard and Summers divulge that any changes in actual unemployment will have permanent effect on the equilibrium level of unemployment i.e. unemployment rate contains random walk process. Equilibrium unemployment rate, hence, depends on the path and actual unemployment rate that moves around equilibrium path slowly.
- Instead, Phelps (1967) and Friedman (1968) argue that technological development, monetary policy changes, human resource development, and macroeconomic changes in an economy affect unemployment but keep the actual unemployment rate around equilibrium level of unemployment. This shows that unemployment rate contains a stationary process which indicates that equilibrium level of unemployment is determined by actual unemployment rate in previous periods.

Empirical studies by Mitchell (1993), Røed (1996), Yilanci (2008), Fosten and Ghashray (2011), Huang (2011), Liew et al. (2012) and Cheng et al. (2014) confirmed the presence of unemployment hysteresis hypothesis, i.e. unemployment contains random walk process (unemployment is non stationary).

Instead, Song and Wu (1998), Arestis and Mariscal (1999 and 2000), Lee and Chang (2008), Lee et al. (2009), Lee (2010), Evera et al. (2001) and Lee et al. (2013) reject the hypothesis of unemployment hysteresis, i.e. unemployment rate contains stationary process which implies that shock affects unemployment rate but temporarily.

A very recent and interesting paper by Khraief et al. (2015)⁵⁸ supports stationarity of the unemployment rate. The authors assert the idea that when the data generating process exhibit non-linearity (as it happens with the unemployment rate series), the linear unit root tests (ADF, Phillips-Perron and KPSS) may not possess good power, i.e. they tend to over accept the unit root null hypothesis. They re-examine the dynamics of unemployment rate for 29 countries from OECD over the period between 1980 and 2013: their empirical findings provide significant evidence in favour of unemployment rate stationarity for 25 countries, rejecting the unemployment hysteresis hypothesis⁵⁹.

Hence, not surprisingly, the level form estimation delivered better results than the differenced one, supporting the idea that when short time series are available differencing or over-differencing might not be the best option to improve the estimation⁶⁰. Moreover I seasonally adjusted the HSR variable and the Deficit/Surplus to GDP ratio.

I selected the appropriate length of lags to be included in the model using the Akaike's information criterion (AIC) and the Hannan and Quinn information criterion (HQIC) tests since I am working with quarterly data. Both criterions suggest to use two lags for all our variables.

Before proceeding with the econometric analysis, the usual cautionary remarks are needed when using macro data. I followed the savings literature and interpret 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 labour 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.

⁵⁸ "Are Unemployment Rates in OECD Countries Stationary? Evidence from Univariate and Panel Unit Root Tests", IZA DP No. 9571, December 2015, *Naceur Khraief Muhammad Shahbaz Almas Heshmati Muhammad Azam*.

⁵⁹ According to them, unemployment rates are expected to return back to their natural levels without executing any costly macroeconomic labour market policies by the OECD's governments.

⁶⁰ "There is also an issue of whether the variables in a VAR need to be stationary. Sims (1980) and Sims, Stock and Watson (1990) recommend against differencing even if the variables contain a unit root. They argued that the goal of a VAR analysis is to determine the interrelation among the variables, not to determine the parameter estimates. The main argument against differencing is that it "throws away" information concerning the comovements in the data (such as the possibility of cointegrating relationships). Similarly, it is argued that the data need not be detrended. In a VAR, a trending variable will be well approximated by a unit root plus drift. However, majority view is that the form of variables in the VAR should mimic the true data-generating process. This is particularly true if the aim is to estimate a structural model"(Walter Enders, "Applied Econometric Time Series, 3rd ed.").

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 select a meaningful order of the variables; this is done by using Cholesky factor.

The Wold representation for the SVAR model is:

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

Where, considering a two lags specification,

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

- HSR_t = Savings Rate,
- X_{it} = Stock Index Price Volatility,
- UR_t = Unemployment Rate ,
- 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.

3.3 Cholesky Identification Scheme

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 the analysis I refer to the standard Cholesky Factorization procedure to orthogonalize the shocks. Cholesky decompositions are easy to implement and simple to understand. The triangular scheme of the Cholesky factor achieves orthogonalisation but imposes a recursive structure on the contemporary relationships of the

variables. How the variables are ordered in the VAR will determine which is affected by which in this recursive way⁶¹.

I considered three different orderings to serve the purpose of the analysis, providing the economic reasons and motivation behind choosing a specific order and according to several empirical papers.

Each ordering always presents three variables (*savings rate, unemployment rate and standard deviation of the financial stock prices of each country*) and a different fourth variable depending on the index chosen (*policy uncertainty index, debt over GDP or deficit/Surplus over GDP*).

Table 1 : Cholesky Orderings

	I Ordering	II Ordering	III Ordering
1 st Variable	Stock Index Price Volatility	Stock Index Price Volatility	Stock Index Price Volatility
2 nd Variable	Deficit/Surplus over GDP	Debt over GDP	Policy Uncertainty index
3 rd Variable	Unemployment Rate	Unemployment Rate	Unemployment Rate
4 th Variable	Savings Rate	Savings Rate	Savings Rate

Table 1 summarizes the three orderings: for each of them the “Stock Index Price Volatility” is placed as first variable. This choice is supported by the so called “new view” theory by Beaudry and Portier (2006), emphasizing how the stock index is able to capture today future shocks in technological innovation, consumption, investment, hours worked and so on and so forth. Stock prices are considered good indicators in reacting to any changes in agents expectations on future economic conditions. As a matter of fact, stock price is considered an “unhindered jump variable” which means that, as soon as a piece of new information is delivered, the stock prices immediately react without lag. A classic example in this regards is total factor productivity: 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,

⁶¹ When using a Cholesky decomposition scheme for any SVAR, the ordering of the variable is crucial because orthogonalised innovations to the first element affect all other dependent variables in the system, while the same shocks to the second variable only affect the subsequent variables, and so on. In other words, only the first variable in the ordering can contemporaneously affects all others, the second variable can affect all the following and so on, until the final variable does not contemporaneously affect any other variables. The ordering of the variables thus determines the direction, or channel, of causation. Naturally, varying the ordering of the dependent variables typically generates different results and impulse response function, which is why the ordering of the baseline specification has to be grounded on a credible theoretical argument.

between the moment that agents recognize a technological innovation and its actual impact on productivity in the economy.

Debt and Deficit/Surplus as percentage of GDP are placed as second variable respectively in the I and II orderings. This placing corresponds with the belief that a shock in one of those variables instantly affects the subsequent variables Unemployment and Private Savings.

The effect of fiscal policy on the economy has been subject to considerable interest in recent years⁶². Most of the literature have analysed the effect of fiscal policy on GDP, while the literature exploring the effect on unemployment is much smaller. This distinction is important because the effect on unemployment may differ from the effect on GDP. Fiscal actions can lead to increased labour supply and increased unemployment even if output grows. Alternatively, if cuts in government purchases induce higher private sector output, and productivity is higher in the private sector, GDP may grow even if unemployment increases. The ambiguity is reflected in recent research: Monacelli et al. (2010), IMF (2010), Auerbach and Gorodnichenko (2012b) and Ramey (2012) conclude that an increase in government spending leads to lower unemployment, instead Bruckner and Pappa (2012) find that increased government spending lead to higher unemployment due to increased labour force participation. The recent financial crisis has rekindled the debate on how fiscal policy affects unemployment: increasing public debt and rising default premia on sovereign debt have led to substantial fiscal tightening in many countries and at the same time unemployment has soared. In this regards a very recent paper by Holden and Sparrman (2015) estimate the effect of government purchases on unemployment in 20 OECD countries, for the period 1980-2007. They find that an increase in government purchases equal to 1% of GDP reduce unemployment by about 0,3 % in the same year⁶³.

A change in government budgets has also an impact on private saving. The theory that rational private households might shift their saving to offset government saving or borrowing is known as Ricardian equivalence. According to Ricardian equivalence, the economic agents regard present tax cuts as future tax burden because the agents are assumed to be foresighted. The agents realize that present value of taxes depends on real government spending, not on the timing of taxes. Therefore an increase in debt cannot stimulate the aggregate demand, and as a result, the increase in debt has no real effects⁶⁴. In other words, if Ricardian equivalence holds

⁶² Auerbach et al. (2010), Beetsma and Giuliadori (2010), and Ramey (2011)

⁶³ The effect is greater and more persistent under less "employment-friendly" labour market institutions, and greater and more persistent under a fixed exchange rate regime than under a floating regime. The effect is also greater in downturns than in booms.

⁶⁴ Ricard Barro (1974).

completely true, any change in budget deficits or budget surpluses would be completely offset by a corresponding change in private saving and changes in government borrowing would have no effect at all on either physical capital investment or trade balances.

Many empirical studies show big differences to each other, some are favourable and some others are unfavorable to Ricardian equivalence. These conflicting results seem to come out due to econometric reasons (Aschauer 1985). This means that estimation results are very sensitive to measurement and methodological issues. Especially, misspecification, omitted variables, or endogeneity problems may lead to biased estimates of some coefficients (Feldstein 1982, Aschauer 1985, Seater 1993, Graham 1993). In general terms, the private sector only sometimes and partially adjusts its savings behaviour to offset government budget deficits and surpluses. So private saving does increase to some extent when governments run large budget deficits, and private saving falls when governments reduce deficits or run large budget surpluses. However, the offsetting effects of private saving compared to government borrowing are much less than one-to-one. In addition, this effect can vary a great deal from country to country, from time to time, and over the short run and the long run.

In ordering III instead policy uncertainty is placed as second variable. This index includes several components, among them the frequency of news coming from different “means of communication”, that is why it can be to some extent compared to the stock index variable, being capable of incorporating instantaneously news coming from the economic and financial market. Obviously the PU index is due to more specific and selected components, hence reacting to news delivered in the economy specifically related to policy uncertainty, which is why PU is placed just right after the volatility of the stock index variable.

A recent study by Vichet Sum (2013) can in part confirm this order: he empirically reports the impulse response functions of economic policy certainty and financial stress and conduct a causality test of these two variables. The analysis shows that EPU jumps in the first, third, fourth, sixth, seventh, and ninth months following financial stress shocks⁶⁵. Hence, economic policy uncertainty reacts immediately to a shock due to a financial stock index.

Policy uncertainty has also a direct impact on unemployment. According to Bloom (2009), which based his study on previous model by Bernanke (1983), the entrepreneurs facing an uncertain economic environment are more willing to implement "wait-and-see" strategies hence reducing investment. As a consequence, economic activities slowdown in the short run leading to a shrink in production and in the employment level. Leduc and Liu (2013) study the labour

⁶⁵ The Granger causality test shows that financial stress and economic policy uncertainty Granger-cause each other.

market in the US, after the "great depression" and during the following recovery phase: using the Beveridge curve they find that, even though the number of job openings in the economy has been rising during the recovery, the unemployment rate has remained stubbornly high. As a result, there are now more jobless workers for a given number of job openings than in the decade before the downturn. The empirical evidences provided by the authors suggest that heightened uncertainty about economic policy during the recovery made businesses more reluctant to hire workers. The effect of policy uncertainty is investigated also through theoretical models like the one developed by Johanssen (2013). Using a New-Keynesian model with endogenous capital accumulation, he shows that uncertainty about both short-run and long-run fiscal policy can cause a large contraction in the economy. A recent study by Moraleschi and Rossetti (2014) investigates the effect of policy uncertainty (EPU index) on the unemployment level in Europe. They find the two variables are positively related in the long run. In particular, in a OLS regression with controls regarding the main economic variables affecting unemployment, fixed effects for countries and time, they find that an increase in the economic policy uncertainty induces an increase in the unemployment. Moreover, they find a cointegrating long-run relationship between Italian unemployment and Italian EPU.

Unemployment and Savings rate are placed respectively as third and fourth variable in all the three orderings. The idea behind this choice is the existence of permanent income and risk averse households who prefer to smooth consumption over their lifetime. Households start saving when "realized income" is higher than "expected income". In the opposite case, when realized income is lower than the expected one, households in order to finance their current consumption, either borrow or withdraw money from saving. This reasoning is in line with the countercyclical behaviour that suggests to save during normal periods or when high incomes are uncertain and dissave during adverse period due to negative economic shock such as higher unemployment. As a matter of fact, an increase in the unemployment rate causes higher labour income uncertainty, affecting both current and expected income, which in turn influences households' saving decisions. Moreover, accordingly to the PHI and the LCH, when uncertainty over future income increases, current consumption falls and saving increases. Many empirical papers find evidence to support those hypothesis in both developed and developing economies and study the impact of unemployment on private savings⁶⁶, which can support the choice of ordering unemployment first and savings after in the SVAR specification.

⁶⁶ e.g. Xin Meng (2003), Christoph Basten (2013).

3.4 Impulse Responses Analysis

In this paragraph I analyse the cumulative impulse response of saving rate to a unit shock for each variable, hence focusing on the long run effect. The long-run cumulative impulse response of the structural shocks (C-IRF) gives the total cumulative effect of a unit shock on the entire future of the time series (that is the sum of the IRF over all time horizons), which allows to analyse the persistence of shock to economic time series. The confidence interval for the error band is 0,90.

3.4.1 Policy Uncertainty

Policy-related uncertainty has been a key factor slowing the recovery from the recession of 2007-2009: greater uncertainty about future taxes, spending levels, regulations, health-care reform, and interest rates lead businesses and households to postpone spending on investment and consumption goods, slowing hiring and impeding the recovery.

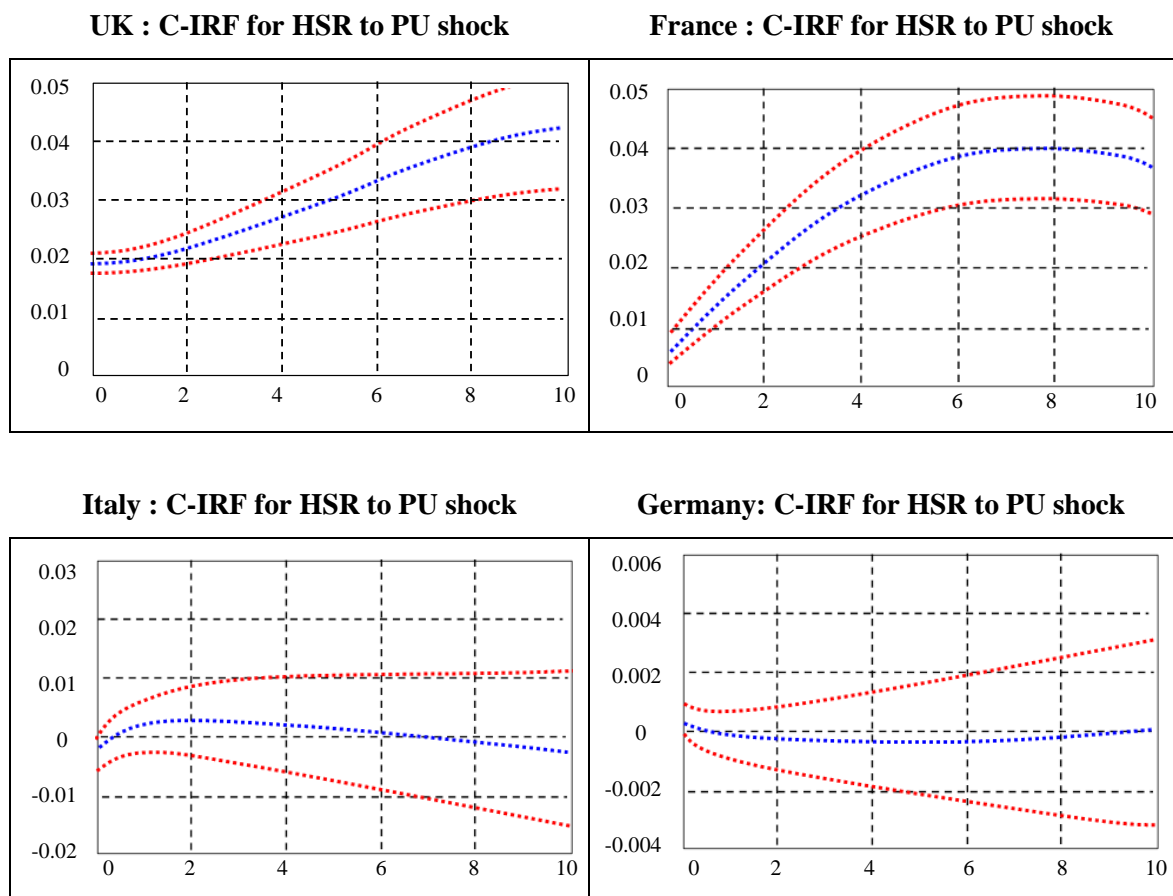
In order to investigate to what extent this source of uncertainty affected household saving rate, I included in the empirical model an indicator for policy uncertainty. I employed three measures to account for that.

First, I 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 2001 onwards, hence I didn’t include it in the analysis due to the too short time series.

Household saving accumulated impulse responses, over 10 quarters length, to this indicator are plotted in Figure 5.

Only two countries UK and France show a significant positive pattern, suggesting a persistent effect of a unit shock in EPU on household saving. The other two countries, Italy and Germany, for which the index was available, show instead impulse responses around zero.

Figure 5 : Cumulative Impulse responses to Policy Uncertainty shocks



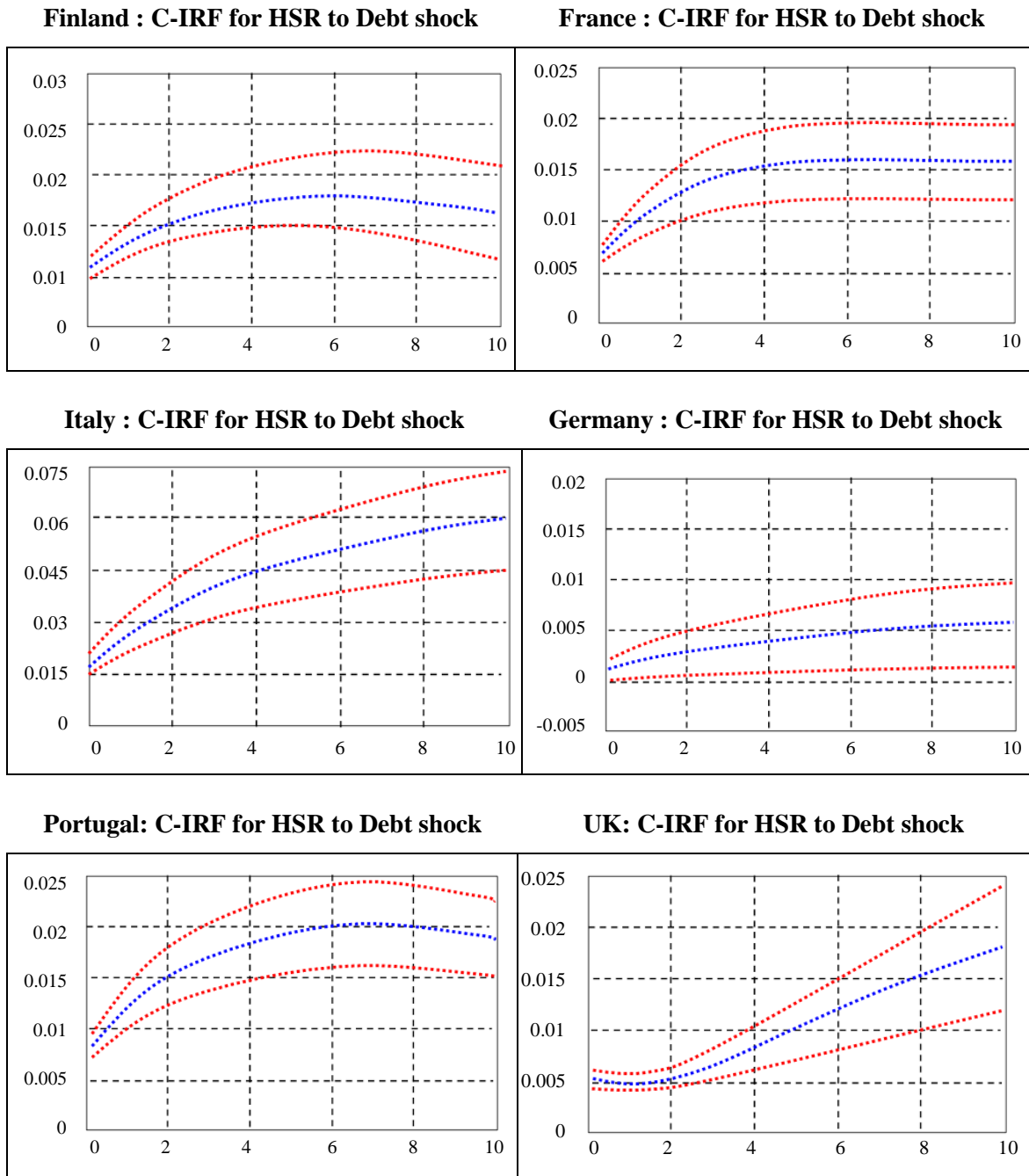
I then performed two additional estimations of the model by replacing the Nick Bloom Index alternatively with two other possible indicators to account for fiscal policy uncertainty: the Government Debt-to-GDP and the Deficit/Surplus to GDP ratios.

As previously mentioned, the availability of the Nick bloom index was limited to only a few countries, therefore using these two different variables allows to extend the analysis to 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 6 allows a comparison of countries' accumulated impulse response of Household saving rate to a unit shock in the Debt to GDP ratio.

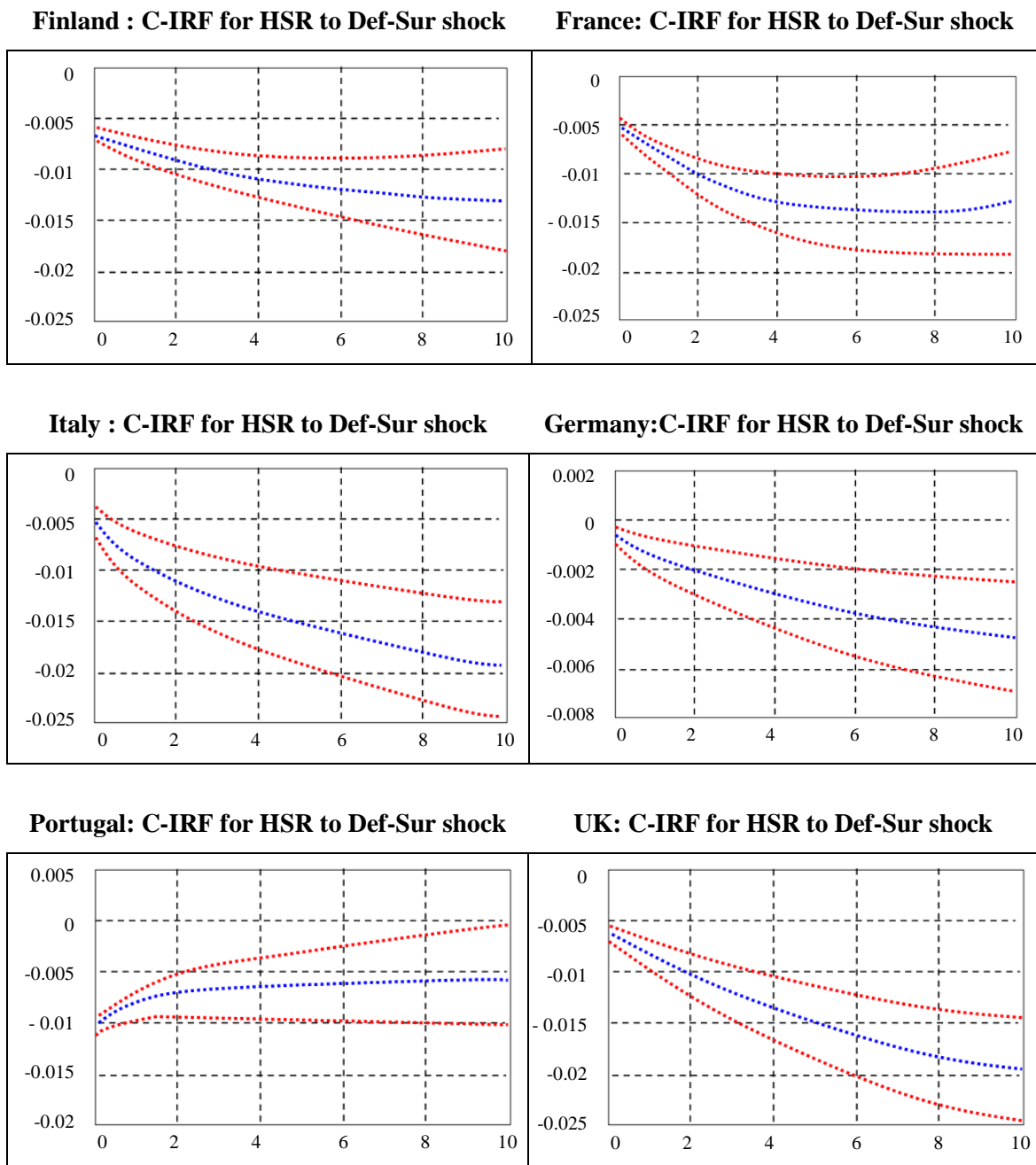
Figure 6 : Cumulative Impulse responses to Debt shock



Cumulative impulse response functions are significant for the six countries, all showing an upward trend but differences in terms of magnitude. In particular France's response increases slightly at the beginning and then after one year stabilizes over time. Finland and Portugal show a peak around the six and seven quarter respectively and then start to slowly decrease. Italy, Uk and Germany display an increasing pattern over the entire horizon, with Italy showing the higher impact in terms of magnitude.

Figure 7 shows impulse responses to a shock in the Deficit/Surplus to GDP ratio. As expected, compared to the previous Debt to GDP shock, the sign is reversed when the deficit/surplus ratio to GDP is used. All countries present a significant downward pattern. In particular, Portugal's response shows a reduction "on impact" followed by a soft increase and then stays at a constant level. France's response decreases at the beginning and then after eight quarters increases slowly.

Figure 7 : Cumulative Impulse responses to Deficit/Surplus shock



The above results would partially confirm the idea that fiscal policy can influence the savings pattern of the private sector. The already mentioned Ricardian equivalence hypothesis, suggests that private sector savings adjust in response to public sector deficits or surpluses. 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 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. 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 considering what is called an expansionary fiscal consolidation policy. 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 Experts⁶⁷.

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 Treaty⁶⁸. 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.

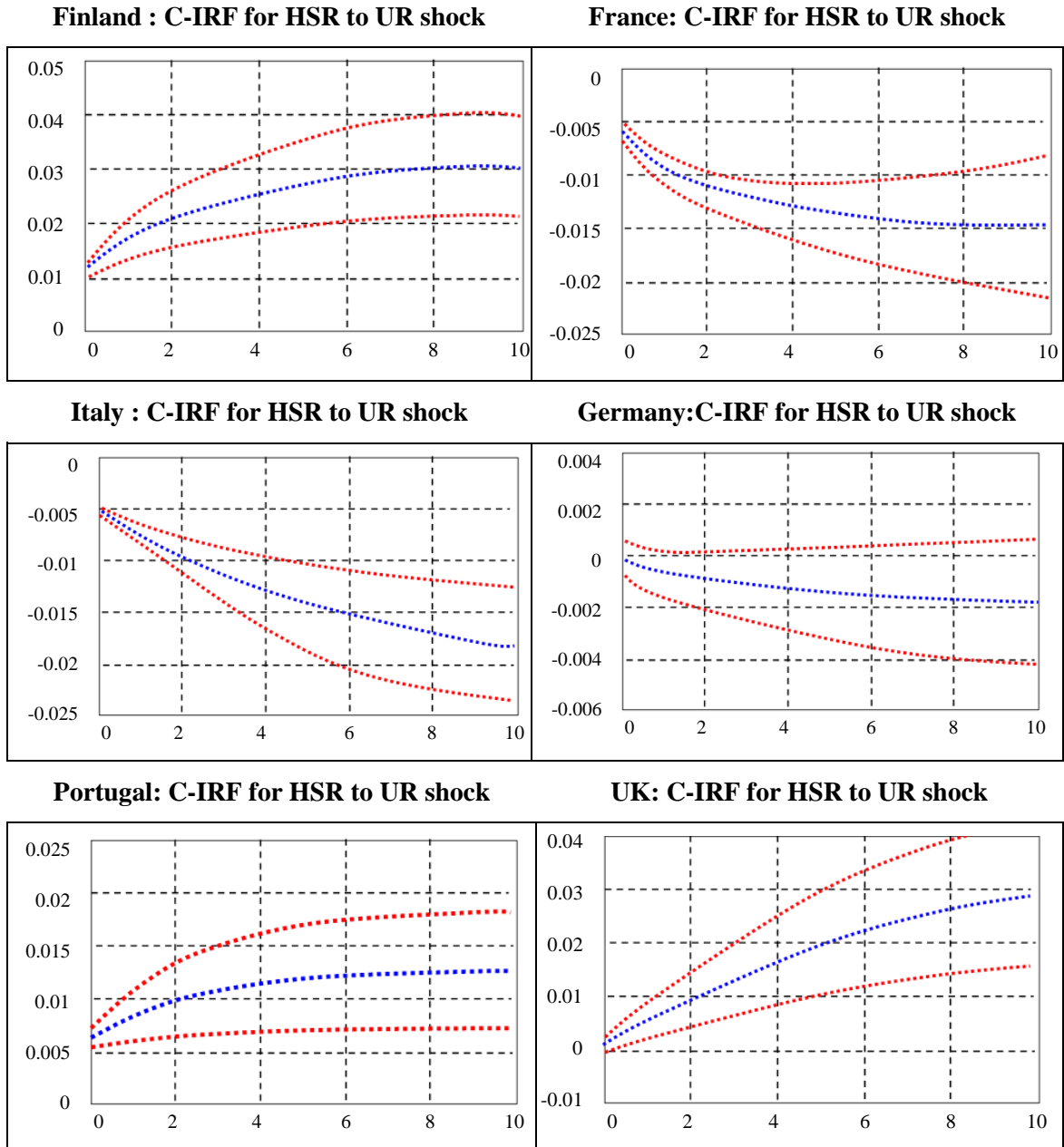
⁶⁷ Hellwig and Neumann, 1987.

⁶⁸Expansionary fiscal consolidations were initially studied for Denmark in 1983-86 and Ireland in 1987-89; Giavazzi and Pagano, 1990.

3.4.2 Unemployment Rate

The effect of the unemployment rate on household savings, instead, is not as definite⁶⁹. 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 more⁷⁰.

Figure 8 : Cumulative Impulse responses to Unemployment rate shock



⁶⁹ Impulse Responses for the Cholesky Ordering II in Table 1. However, these effects are qualitatively robust when employing the other orderings. This is crucial to ensure that the results do not depend on some possibly incorrect assumptions about the behaviour of the variable and their relationship (Stock and Watson, 2001).

⁷⁰ The empirical results of Edwards (1995) seem to favour the former explanation.

Based on Figure 8, the following conclusions are reached:

- the cumulative impulse response is not significant for Germany;
- 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;
- impulse responses of HSR to Unemployment shock are instead positive for Finland, Portugal and UK. This could suggest that greater labour income uncertainty is significantly associated with higher household savings, hence saving rate increases in response to higher unemployment. An increase in labour 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 labour income risk and also by reducing expected income.

3.4.3 Financial Uncertainty - Investment Risk

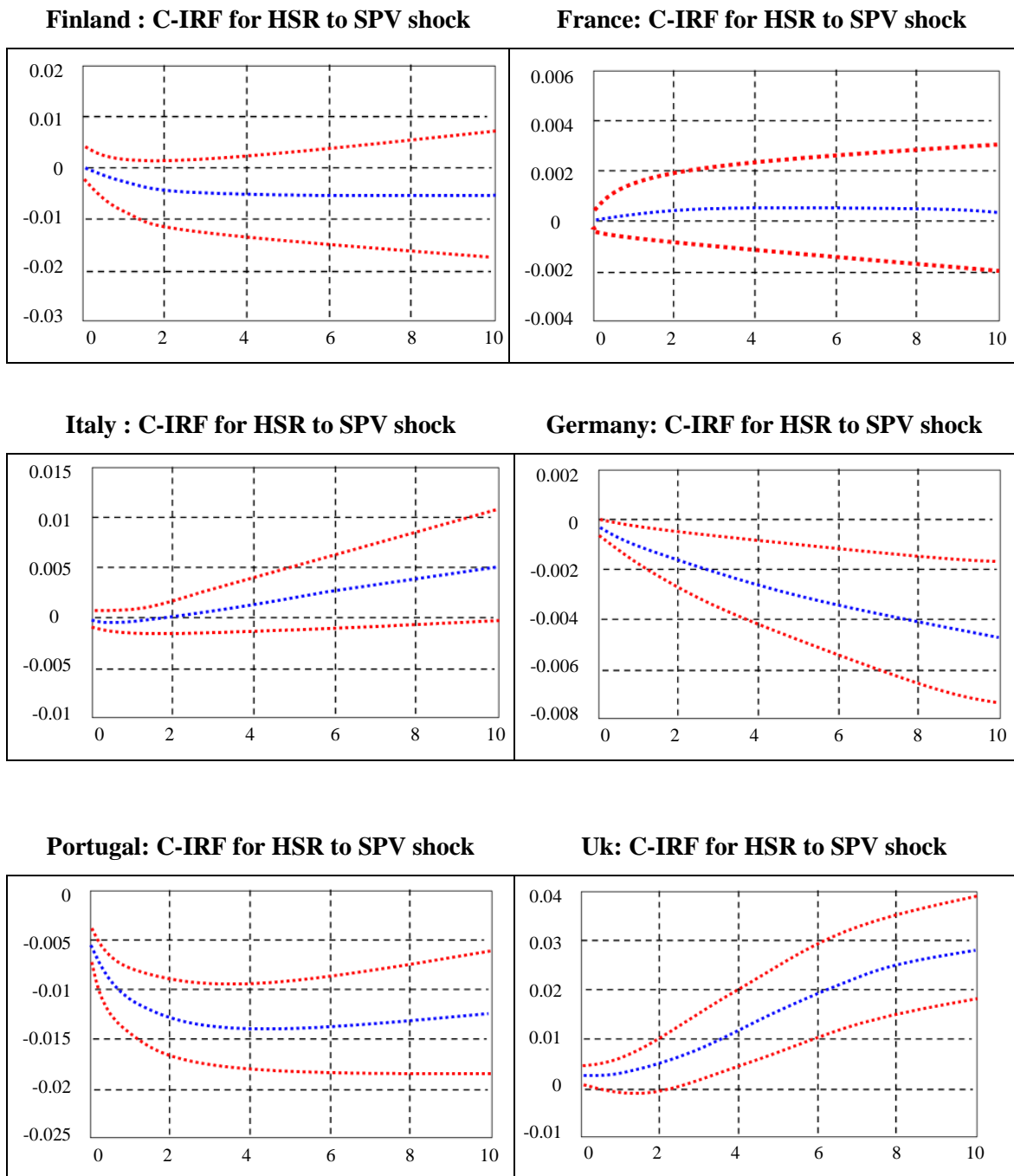
The cumulative impulse responses of Household saving rate to Stock Index Price Volatility shock⁷¹ are plotted in Figure 9. A unit investment risk shock has no clear impact on the saving rate: it does not have a significant impact on the saving rate for Finland, France and Italy, whilst implies a negative pattern for Germany and Portugal saving and a positive one for UK.

According to the precautionary saving theory, higher financial risk measured by larger market volatility indicators should brought to higher saving; however, when market volatility is extreme or financial forms of instability turn into crises, individuals lose confidence in those financial instruments and also in the institutions that issue or back them, as a response saving decline.

In other words, 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.

⁷¹ Impulse Responses for the Cholesky Ordering II in Table 1.

Figure 9 : Cumulative Impulse responses to Stock Index Price Volatility shock



4. BAYESIAN FRAMEWORK

In this section I would like to propose another possible approach to the analysis to be explored and deepen in future research. The future purpose is to analyse the impulse responses due to a shock in each of our variables (unemployment rate, policy uncertainty, deficit over GDP, debt over GDP and Stock Price Volatility) on the saving rate in “aggregate term” which means not for each country but for all countries as an aggregate.

The problem in running a simple VAR is that the 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.

Applying a Bayesian estimation which implements the Hierarchical Linear Model (Multilevel Model) of Gelman et al. (2003) can surely improve the estimation and mitigate the main obstacle of a moderate size for the time series. It would also allow to extend the analysis to other European countries with limited observation data series.

Hierarchical linear modeling (HLM) is a powerful and flexible statistical framework for analysing complex nested relationships⁷², and it is used across a variety of disciplines to examine multilevel effects. Multilevel modeling is a generalization of regression methods⁷³, and as such can be used for a variety of purposes, including prediction, data reduction, and causal inference from experiments and observational studies. Compared with classical regression, multilevel modeling is almost always an improvement, being useful for data reduction and helpful for causal inference. An interesting feature of multilevel models is their ability to separately estimate the predictive effects of an individual predictor and its group-level mean, which are sometimes interpreted as “direct” and “contextual” effects of the predictor.

Regarding the specific analysis of this thesis, implementing a Hierarchical Linear Model would allow to exploit cross-regions and cross-countries comparison. This method would assume 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. In other words, countries are not forced to have the same identical parameters, reactions to shocks, but are allowed to slightly differ among each other, given the assumption that household savings rate will not react very

⁷² In education, for example, we may be interested in factors that affect student achievement. Broadly, it is possible to theorize factors associated with the school (school social groups, principal leadership, school size), the teachers (effectiveness of the teacher, specific expertise of the teacher, relationship of the teacher with the student), and the students themselves (motivation, previous achievement, general intelligence). Each of these factors associated with student achievement could be conceptualized as different “levels” of nesting – students (at Level 1) are nested within classrooms (at Level 2), which are nested within schools (at Level 3) – in which each level potentially impacts student achievement.

⁷³ Multilevel modeling includes least squares regression as a special case.

differently across the countries. This idea of similarity is formalized as a Gaussian prior for each country's coefficients, which is centred 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.⁷⁴

A first step in this research is to compute the Averages Impulse Response Functions of Household Saving Rates to all variables' shocks⁷⁵. The results are fairly consistent with the country-specific 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 is not considerably relevant;
- Impulse response to Investment Risk or Financial Uncertainty is not particularly significant given that single-country analysis showed no variations of Household saving rates for three countries over six.

⁷⁴ 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

⁷⁵ Figure 10 in the Appendix.

5. CONCLUSIONS

5.1 English version

This PhD thesis attempts to investigate the role of economic uncertainty in driving the behaviour of household savings for six European countries: Finland, France, Germany, Italy, Portugal and United Kingdom (UK). Greater uncertainty or worsening in economic circumstances was expected to increase the incentive of households to save as they pursue to protect themselves against the higher likelihood of adverse outcomes.

Focusing on three main sources of economic uncertainty Unemployment Risk, Fiscal Policy Uncertainty and Financial Crisis-Investment risk, I construct a Structural Vector Autoregressive (SVAR) model comprising of the Household Saving Rate, main variable of interest; the unemployment rate, to proxy labour income uncertainty and the risk of an income loss; the volatility of financial stock prices per each country, to detect for the presence of financial uncertainty/crisis; a policy uncertainty indicator using alternatively the Policy Uncertainty Index devised by Baker, Bloom, and Davis (2012), the Debt to GDP ratio or the Government Surplus/Deficit to GDP ratio. A comparison among country-specific cumulative impulse response functions suggests that:

1. Household saving rate's response to a change in investment risk is ambiguous, due to two counterbalancing effects: on one hand, higher financial 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. Empirical results display that a unit investment risk shock does not have a significant impact on the saving rate for Finland, France and Italy, whilst implies a negative pattern for Germany and Portugal saving and a positive one for UK.
2. A labour uncertainty shock is detrimental or a booster for saving depending on whether the downward pressures on saving rate due to lower saving from unemployed people, prevails or not over the higher households propensity to save for precautionary reasons. 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; impulse responses of HSR to Unemployment shock are instead positive for Finland, Portugal and UK.
3. Fiscal policy instruments and related uncertainty influence the savings pattern of the private sector: private saving falls when governments reduce deficits (or the debt level) or run large budget surpluses and vice versa, as suggested by the Ricardian paradigm.

I then propose another possible approach to the analysis, a Bayesian estimation of the reduced form VARs for the panel of European countries, as a Hierarchical Linear Model, with the future aim of improving estimation results and to exploit cross-regions and cross-countries comparison. This method would allow to overcome the problem of having a model with many parameters, few countries and limited time series.

Further research can be directed to fully exploit the Hierarchical Linear Model analysis, since the Bayesian Methods would improve the estimation, and also to define a theoretical model that could explain the assumptions to carry out the identification of structural shocks. Furthermore, it would be interesting to focus attention on the behaviour of Precautionary Savings rather than Saving Rate, in order to analyse the «excess of saving» driven by the three sources of uncertainty.

5.2 Italian version

La tesi di dottorato si intitola “Effects of Uncertainty on Household Saving Rate”: la ricerca si occupa dell’indagine del ruolo dell’incertezza economica nel guidare il “comportamento di risparmio” delle famiglie in differenti paesi. “Disaggregare l’incertezza” permette un nuovo approccio per modellare e valutare l’attività economica. Il contributo di tale lavoro vuole essere quello di eseguire un’analisi sulla “propensione al risparmio” basato su macro-dati piuttosto che su micro-dati, maggiormente utilizzati in letteratura per studi a tal riguardo, relazionandola ai recenti avvenimenti, alla crisi economica ed il tipo di instabilità che ha generato. La ricerca si è focalizzata su tre principali fonti di incertezza economica: il rischio di disoccupazione (Unemployment Risk), incertezza politica-fiscale (Fiscal Policy Uncertainty) e crisi finanziaria (Financial Crisis-Investment risk). Sono stati individuati indicatori che svolgessero da proxy per le sopra elencate fonti di incertezza: si è preso in considerazione il tasso di disoccupazione come proxy per la “labor income uncertainty” ed il rischio di “income loss”; la volatilità del “domestic stock market” di ciascun paese per l’incertezza finanziaria; ed infine con riferimento alla “policy uncertainty” sono state utilizzate alternativamente tre differenti variabili, un indice costruito Baker, Bloom, and Davis denominato “Policy Uncertainty Index”, il “Debt to GDP ratio” ed il “Government Surplus / Deficit to GDP ratio”. La ricerca si articola in tre parti principali: nella prima parte si espone una revisione della letteratura sui saving, sulla connessione tra incertezza ed attività economica, ed una digressione sulla cosiddetta Economic Policy Uncertainty; nella seconda si è proceduto con l’indagine empirica e quindi ad effettuare una analisi macroeconomica SVAR per ogni paese; infine, nella terza si espone un altro possibile approccio all’analisi, ovvero mediante una stima bayesiana e l’utilizzo dei cosiddetti

Hierarchical Linear Model. Da un'analisi pura dei dati si è osservato come i tassi di risparmio delle famiglie differiscono in modo significativo tra i paesi dell'Unione europea, differenze persistenti nel tempo. Tali differenze tra paesi possono avere importanti implicazioni per l'economia in generale: il risparmio delle famiglie determina in misura importante la disponibilità di credito per finanziare gli investimenti da parte delle imprese e del governo; un risparmio delle famiglie insufficiente può quindi ostacolare gli investimenti e frenare la crescita economica; la disparità dei tassi di risparmio delle famiglie può suggerire che alcuni paesi si affidano maggiormente al risparmio estero per finanziare gli investimenti interni rendendo questi paesi più vulnerabili agli shock esterni; etc. Nell'analizzare le Impulse Response Functions (le funzioni di reazione) del tasso di risparmio alle fonti di incertezza economica considerate si è osservato una relativa diversità di reazione agli shock fra i principali paesi europei. Un'interpretazione economica per ogni reazione osservata è stata presentata, prendendo in considerazione anche le specificità di ogni singolo paese. In particolare, con riferimento al tasso di disoccupazione, l'effetto sul risparmio delle famiglie non è univoco per tutti i paesi. La supposizione iniziale era che un aumento della labor income uncertainty, cioè una maggiore incertezza sul reddito, sarebbe dovuta risultare in un maggior tasso di risparmio dal momento che le famiglie accumulano uno stock maggiore di ricchezza-risparmio per compensare probabili shock avversi. Shock economici derivano solitamente dall'andamento del business cycle, così come da financial frictions, operazioni di ristrutturazione economica, ed a causa di tali shock, le famiglie sperimentano periodi difficili di inaspettata riduzione del reddito. Seguendo quindi le teorie del Life-Cycle e del Permanent Income le famiglie risparmierebbero di più per rendere omogeneo il loro consumo durante tutta la loro vita e per contrastare l'incertezza futura. Tuttavia alcuni paesi hanno presentato un incremento del tasso di risparmio, mentre altri una riduzione. Si è quindi giunti alla seguente considerazione, oltre all'effetto presentato pocanzi, in base al quale un tasso di disoccupazione più elevato induce le famiglie a risparmiare di più, vi è anche un altro aspetto: un aumento del tasso di disoccupazione implica un maggior numero di disoccupati, i quali tendono ad avere risparmi inferiori, simili alle persone in pensione, che quindi aggiunge pressioni al ribasso sul tasso di risparmio delle famiglie. L'analisi svolta ha mostrato ad esempio che per paesi come l'Italia e la Francia la disoccupazione è dannosa per il risparmio, suggerendo che l'impatto di redditi più bassi domina l'effetto positivo della maggiore necessità di risparmio a causa della maggiore incertezza, mentre le risposte del risparmio ad uno shock del tasso di disoccupazione, sono risultate positive per Regno Unito e Finlandia, con una predominanza del primo effetto. Anche con riferimento alle variazioni del rischio di investimento (incertezza finanziaria) la risposta del tasso di risparmio è soggetto a due effetti che si controbilanciano: da un lato, un elevato rischio aumenta

la volatilità del consumo futuro e stimola l'accumulo di risparmio, dall'altro, un tasso più incerto di rendimento riduce l'attrattiva del risparmio, poiché aumenta il rischio di perdite in conto capitale. L'impatto complessivo è pertanto ambiguo. L'incertezza politico-fiscale è stata definita da molti studiosi fattore chiave nel rallentare la ripresa dalla recessione del 2007-2009: in linea generale le imprese e le famiglie se incerte sulle tasse future, sui livelli di spesa pubblica, normative, riforme e tassi di interesse dei bond statali possono rinviare la spesa per investimenti e di beni, rallentando così assunzioni ed occupazione, ed impedendo la ripresa. I risultati dell'indagine hanno in larga parte confermato l'idea che la politica fiscale influenzi il pattern del risparmio del settore privato. L'ipotesi di equivalenza ricardiana suggerisce che il risparmio del settore privato si aggiusta in risposta ai deficit del settore pubblico o ad avanzi dello stesso. Un calo del saldo di bilancio pubblico (aumento del deficit) è associata a risparmi delle famiglie più elevati, possibilmente catturando effetti ricardiani: ad una diminuzione del risparmio pubblico, il governo finanzia la spesa mediante la tassazione o con l'emissione di bonds. In tal caso, dato che il governo finirà per ripagare il debito mediante un inasprimento dell'imposizione fiscale, i contribuenti dovranno pagare tasse più alte in futuro. Quest'ultimi quindi risparmiano oggi in previsione di futuri aumenti di tasse. In altre parole un calo del risparmio pubblico è compensato da un aumento dei risparmi privati. Se questa equivalenza è considerata valida, il tasso di risparmio privato è correlato negativamente con il risparmio pubblico. I risultati empirici sembrano confermare questi sospetti: i coefficienti stimati del tasso di risparmio e di avanzo del bilancio pubblico sono significativamente negativi.

Ricerche future potranno estendere e migliorare questo progetto di tesi:

- Innanzitutto definendo un modello teorico che possa solidamente motivare l'identificazione degli shock strutturali;
- Sviluppare integralmente l'analisi e la stima Bayesiana mediante il Modello Gerarchico Lineare permetterebbe di migliorare qualitativamente la stima ed estendere l'analisi ad un panel di paesi più vasto;
- Inoltre sarebbe interessante focalizzare l'intera indagine sul "risparmio precauzionale" (*precautionary saving*) al fine di studiare ed analizzare l'eccesso di risparmio causato dall'incertezza economica.

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7. APPENDIX

Table 2 presents mean and variance computed over the sample period, for:

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

Table 2: Descriptive Statistics of HSR, PV_FS and UR

	HSR		PV_FS		UR	
	M	σ^2	μ	σ^2	μ	σ^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

Table 3 shows the main statistical properties for the variables used as indicators for Policy Uncertainty over the sample period:

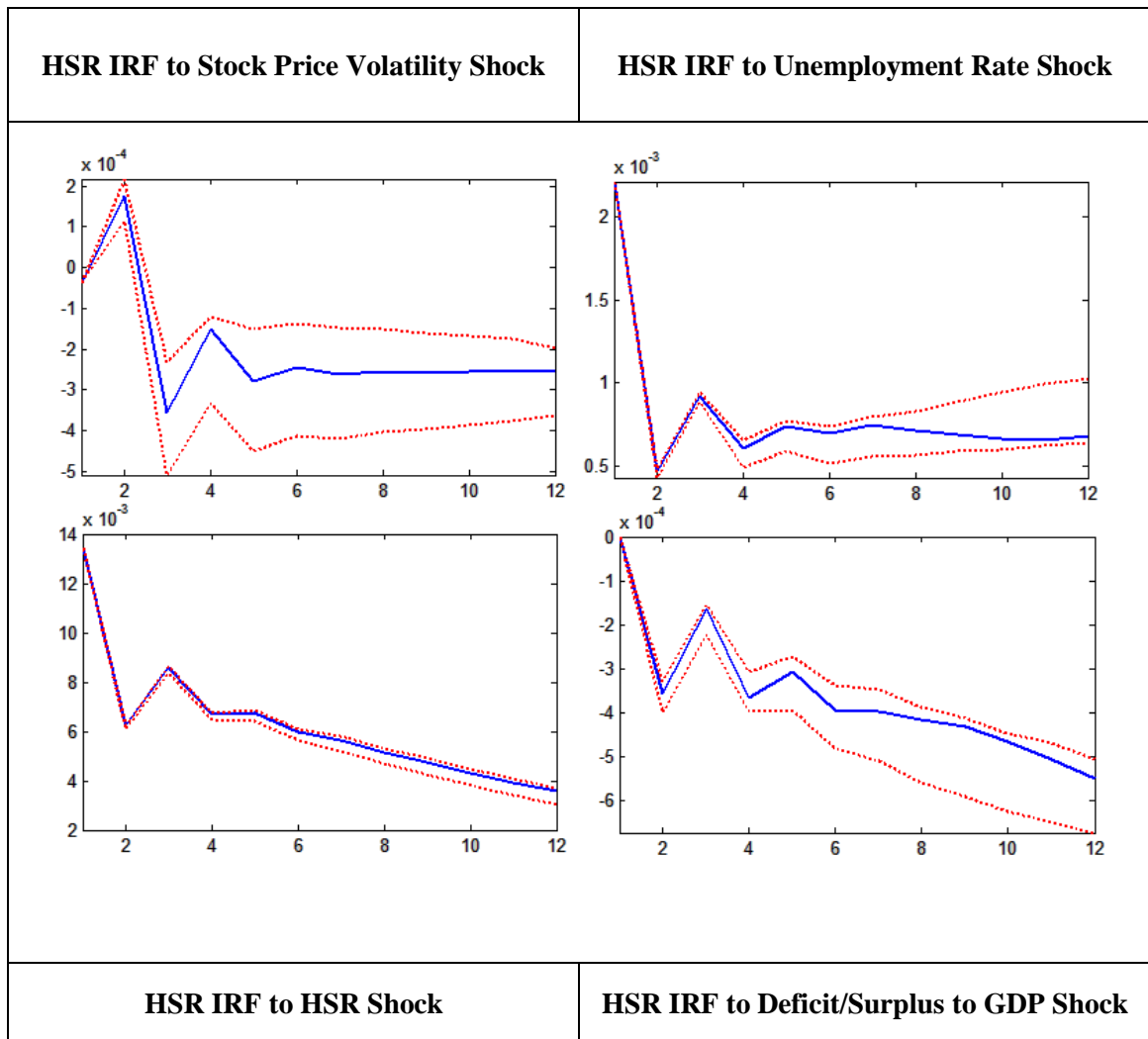
- D_GDP : Debt to GDP ratio
- D_S_GDP: Deficit/Surplus to GDP ratio
- PU: Policy Uncertainty Index

Table 3: Descriptive Statistics of D_GDP, D_S_GDP and PU

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

All data are either in ratio or in rate form so they are unit free.

Figure 10: Countries Average IRFs - Bayesian Estimation



This chart is not particularly revealing and remarkable: it is a preliminary result which obviously requires improvements in structuring and modeling the HLM Bayesian Estimation, that optimistically will be developed in future research.