GLOBAL IMBALANCES AND THE ROLE OF SAVINGS

FOUR ESSAYS

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PREFACE

My PhD thesis is composed by four distinct essays on global imbalances, savings and consumption. The fundamental goal it tries to achieve is an improvement in the understanding on how public saving, private consumption and asset prices fluctuations affect the macroeconomic environment. Particular attention is devoted to the role of household wealth and to the mechanism of the wealth effect. The analysis is mainly empirical, and both aggregate and household-level data have been used in order to better understand the links between the variables of interest.

The thesis is structured as follows. The first essay, *"Global Imbalances and the Economics of Foreign Exchange Reserves,"* introduces global imbalances and provides a survey of the literature on the subject. The role of savings in determining current account balances is analysed and explained. The following two contributions, *"Global Imbalances and Household Savings: the Role of Wealth"* (second essay), and *"Wealth Effect in the US: Evidence from Brand New Micro Data"* (third essay) are two empirical studies that concentrate on one variable that greatly matters in determining global imbalances, namely, household savings. The first one uses aggregate data to estimate the determinants of household savings in a panel of 18 developed countries for the period 1980-2005. The second one concentrates on the USA, the country whose current account deficit is at the root of global imbalances, and uses household-level data to further investigate the mechanism of the wealth effect. The fourth essay, *"The Response of Private Consumption to Different Public Spending Categories: VAR Evidence from UK,"* looks at the interactions between public consumption and private consumption. The empirical analysis is conducted with quarterly data on the UK economy.

The first contribution, *"Global Imbalances and the Economics of Foreign Exchange Reserves,"* introduces the concept of global imbalances and provides a brief survey of the main articles that deal with it. It presents the debate about sustainability and the fear of disorderly adjustments. Then, it focuses on foreign exchange reserves accumulation, which is an important feature of the global imbalances scenario. After a presentation of the cornerstones of the literature, the survey concludes with the most recent studies. In particular, new developments such as currency diversification away from the US dollar and the creation of new sovereign wealth funds, are presented.

The second essay, *"Global Imbalances and Household Savings: the Role of Wealth,"* looks at the global imbalances issue through a saving-investment perspective. This point of view is relevant because low savings in deficit countries (and high savings in surplus countries) help to create and to sustain global imbalances through their influence on current account balances. Household savings are the component of national savings that have experienced the most dramatic changes during the last 25 years. Thus, the essay is an empirical investigation of the determinants of household savings in a panel of 18 OECD countries for the period 1980-2005. The original contribution of this analysis derives from the main explanatory variables of the savings function: two measure of household wealth, financial and tangible/housing, that have never been tested before. Panel cointegration techniques are used to carry out the analysis, and the fully modified OLS is the estimator chosen to estimate the model. The empirical evidence suggests effects consistent with theory, since wealth negatively affects household savings. However, this is true for tangible/housing wealth only and, surprisingly, it is not true in the US. Overall, it seems that the importance that many economists have placed on asset prices to explain the decline of private savings has been overstated.

The goal of the third essay, *"Wealth Effect in the US: Evidence from Brand New Micro Data,"* is to better understand the surprising result for the US economy found in the second essay. Thus, we turn to household-level data, using two different sources: the Consumer Expenditure Survey and the Survey of Consumer Finances (the sample period is 1989-2004). A statistical matching procedure is used to create a unique dataset, in order to overcome a common problem of the previous literature investigating the wealth effect: the lack of high quality data. With our new dataset, we are able to perform a very detailed analysis, decomposing wealth in three different components. Our estimates indicate that there is a significant tangible wealth effect, even if it lies in the low range of the previous literature findings. Again, it is confirmed that financial wealth plays no role in determining the consumption/saving decisions of households, probably because of a certain difficulty faced by households in assessing the actual value of financial assets, and also because of the different perceptions in terms of volatility among the two kinds of wealth.

The final contribution of this thesis, *"The Response of Private Consumption to Different Public Spending Categories: VAR Evidence from UK,"* investigates the mechanisms that

link public and private consumption. With a Structural VAR analysis on UK economy using quarterly non-interpolated data from 1981 to 2005, it aims at verifying and quantifying private consumption's response to different components of public expenditure (government consumption, social spending and wage component). Our findings show that, while shocks to pure government consumption trigger a RBC-like reduction in private consumption, shocks to the non-systematic component of social spending generate positive reaction, in line with the "credit-constrained-agents" approach. The cumulative impact on consumption after three years of a government spending shock is twice as much the social spending shock, with opposite sign. Government wage shocks do not seem to have any significant effects on private consumption. Therefore, public expenditure composition, rather than level, seems to be actually playing the most crucial role when it comes to aggregate demand support via effects on private consumption.

GLOBAL IMBALANCES AND THE ECONOMICS OF FOREIGN EXCHANGE RESERVES

Simone Salotti[÷]

Abstract

This paper deals with global imbalances. First, it introduces the debate about sustainability and the fear of disorderly adjustments. Then, it discusses the main theoretical models that have been used to analyse global imbalances, as well as alternative approaches. In particular, a number of studies that adopt a saving-investment perspective are presented. The second part of the paper is devoted to the analysis of official reserves accumulation, an important feature of the global imbalances scenario. The interest on the subject has recently renewed because of the massive increase of World foreign exchange reserves, that have risen from USD 1.2 trillion in January 1995 to above USD 6 trillion in 2007. This survey examines how economists have analyzed reserves accumulation, starting with the early studies and concluding with the most recent ones, that introduce precautionary, mercantilist and competitive reasons for the hoarding of reserves. New developments such as currency diversification towards the Euro and asset diversification through the creation of new sovereign wealth funds are also presented.

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1. Introduction

Since the end of the Bretton Woods regime, financial globalisation has become one of the key features of the World economy. Gross international capital flows have risen, together with foreign asset and liability positions, and their dispersion has increased. These trends have yielded various consequences, such as enhanced international spillovers from asset price and currency movements (Lane and Milesi-Ferretti, 2005). Moreover, some authors blame financial globalisation to be responsible for the big financial crises that hit Mexico, East Asia, Argentina and Russia during the Nineties (for instance, Stiglitz, 2003).

Financial globalisation also facilitated the creation of the so called "global imbalances". The term "global imbalances" refers to the fundamental imbalance in the global balance of payments, where a widening US current account deficit sees its counterpoint in the surpluses run by a number of countries – mostly East-Asian and oil exporting countries. According to simple accounting identities, a current account deficit necessarily equals capital inflows to the country. Therefore it equals the negative difference between domestic savings and investments. Hence, global imbalances have often been studied by analyzing saving and investment, both from a global perspective and from a US perspective. Two facts emerge. First, a drop in national saving in the USA is at the root of its current account imbalances. Second, a global savings glut has resulted in funds being channeled to the USA and these funds have financed the large US current account deficit. As a result, World official reserves have grown to unprecedented levels. Reserves have risen from 1.2 trillion in 1995 to above 6.3 trillion dollars in 2007 (more than 11% of the World GDP), with a particularly rapid growth since 2002 (see Figure 1). Official reserves are composed by gold (less than 10% of the total amount) and by the foreign exchange reserves, that are divided in bank deposits (around 30%) and securities holdings (the remaining 70%). US Treasuries constitute the bulk of the World foreign exchange reserves. This scenario has raised some concerns about long-term sustainability and about the possibility of disorderly adjustments.[1]

The role played by the US economy is of primary importance in many respects. First, the persistence of the US current account deficit raises questions about the reasons for its financing and about the sustainability of its actual rates. Second, the behaviour of the bond yields both inside and outside the USA is becoming more unpredictable (Warnock and Warnock, 2005). Finally, the role of the dollar as the only international vehicle currency is challenged by fears of great depreciation and by the presence of the Euro, whose importance is growing. This survey deals with a number of aspects linked to global imbalances and the fear of disorderly adjustments.

[1] It is worth to say that the US current account deficit is still recording high values, even though it has slightly declined following the economic slowdown.

The rest of the paper is organized as follows. Section 2 illustrates the problem of global imbalances, and the debate about its sustainability. After a discussion of the main theoretical models that have been used to analyse the international economic situation, alternative approaches to the issue are also presented. In particular, several contributes that adopt the saving-investment perspective are presented. Then, the paper concentrates on one important part of the global imbalances scenario: the role of public savings and of foreign exchange reserves. Section 3 offers a review of the early work on official reserves of the Sixties and the Seventies, and presents the buffer stock model, the workhorse to study the subject. Section 4 deals with the new studies, that investigate the reasons of the recent rates of accumulation. Section 5 deepens the analysis on two open issues: the opportunity cost and the currency diversification towards the Euro. Section 6 is a brief conclusion.

2. The problem of global imbalances

Global imbalances are one of the most outstanding features of the actual international economic scenario. In particular, the US deficit has grown steadily since 2000, exceeding 6% of GDP in 2007 and making the USA increasingly dependent on Asian and oil exporters' Central Banks for financing it (Obstfeld and Rogoff, 2005). This phenomenon has attracted the attention of the economists, mainly because of the potential sharp adjustments that it could imply: exchange rates, current account balances and economic growth could all be dramatically affected in the case of a disorderly adjustment.[2]

Even if the US economy has a key role in the global imbalances scenario, both US-specific and international factors are in play. International liquidity is among the latter. Under the Bretton Woods system, gold was a constraint to the creation of liquidity. Starting from the Seventies, the only limit has became the creation of US Treasuries, which are commonly used as foreign exchange reserves. Actually, there are no limits from the supply side on the amount of assets that Central Banks can accumulate (Clark and Polak, 2004). This has allowed the USA to run large current account deficits that have mainly been financed by foreign official investors.

The following sub-sections present the main theories that deal with global imbalances, in order to illustrate the various aspects of this rather complex phenomenon.

[2] It is worth to notice that there are also a few economists that suggest that global imbalances do not pose any threat to macroeconomic stability (see Hausman and Sturzenegger, 2006, and their discussion on the "dark matter").

2.1 The Bretton Woods II debate

Dooley et al. (2005) have argued that the global system that has evolved and grown since the Bretton Woods agreement (they label as Bretton Woods II the post-1973 period) has maintained a single dynamic structure characterized by three different economic regions: the centre, the periphery (trade account region) and the capital account region. The centre region, the USA, has uncontrolled capital and goods markets. It also acts as the intermediary of the system, since the dollar is the international vehicle currency. The centre region has floating exchange rates, strong exports and run high current account deficits. This latter point is crucial: "(the) US current account growth has been the engine for growth for the rest of the world" (Dooley et al., 2005, p. 13).

The periphery (trade account region) chooses a development strategy characterized by export-led growth with undervalued currencies, controls on capital flows and reserves accumulation, using the centre to borrow credibility for their financial systems: East Asia has this role, previously played by Europe (during Bretton Woods I). The main concern of this region is to export to the centre. Moreover, thanks to the current account surpluses, the official sector heavily invests in US securities.

The capital account region is formed by Western Europe, Canada, Australia and part of Latin America. It has floating exchange rates and its private investors help to finance the growing debt of the USA. The main difference between the trade account and the capital account region is that the latter is formed by countries that allow private international investment decisions to determine important macroeconomic variables such as the real exchange rate and the current account balance, while, in the former, governments intervene more heavily.

Dooley et al. (2005) conclude that the system has been stable and sustainable, therefore the fear of disorderly adjustments is exaggerated.[3] However, this conclusion crucially lies on the hypothesis on the Chinese exchange rate policy. They assume that the dollar peg, that keeps the Chinese currency undervalued, will be maintained indefinitely, since it allows China to preserve exports, and therefore growth. But, the fact that the Chinese currency is currently undervalued is controversial.[4]

As Dooley et al. (2005), Croke, Kamin and Leduc (2005) judge the disorderly correction hypothesis to be unrealistic. Their historical analysis of previous current account adjustments in industrial countries shows that there is little evidence of sharp falls in exchange rates, depressed stock prices and weakness of economic activity during and after adjustments of negative current account positions. However, their threshold to define a current account reversal is very low compared to the actual US deficit. Also, they do not take into account that the US deficit accounts for 75% of the total world deficits, an unprecedented fact that further complicates the scenario.

[3] Their optimistic conclusions are shared by many others: to name one, Greenspan (2004).
[4] See Bergsten, 2004 and 2005, Goldstein and Lardy, 2005, and McKinnon, 2006, for an overview of the debate.

Other authors disagree with these analyses. Goldstein and Lardy (2005) point out that what Dooley et al. call the trade account region is just China, therefore the model does not take into account many important countries. The other big criticism is that the creators of the BW II model misinterpret Chinese policies. For example, they state that the Renminbi is kept undervalued against the dollar in order to favour exports, but they disregard the fact that the USA is not the Chinese major trading partner. In addition, between 1994 and 2002 there has been an appreciation of 30% of the Chinese trade-weighted exchange rate. Goldstein and Lardy (2005) also cast doubts on the forecast of stability of the system, claiming that the costs of sterilization that the Chinese government is facing will soon become unbearable, with consequences on the exchange rate as well as on the accumulation of international reserves.[5] They conclude by saying that China needs to change some of its policies, both in the short (further appreciation against a basket of currencies) and in the long run (reforms of the financial and banking sectors), in order to lower the risk of disorderly adjustments.

Eichengreen (2004) appreciates some traits of the BW II model: the international architecture studied as a system; the analysis of the periphery and its large reserves due both to export led growth and to precautionary motives; the central role of the USA. On the other hand, he criticizes many fundamental points of that analysis, mainly because he thinks that the parallelism between Bretton Woods I and II does not hold. First, Asia has a lower degree of homogeneity compared to Europe during the Fifties. Second, there is another international currency other than the dollar, the Euro, that could play an important role in the evolution of the current situation, for instance as a substitute in case of a diversification of the actual reserves composition. Third, financial globalization and the increased overall fragility of the system are not properly taken into account.

The Bretton Woods II model is not the only model that has been used to study global imbalances. Most of the alternative ones lead to grimmer conclusions than the ones of Dooley et al. (2005), and forecast costly adjustments.

Blanchard, Giavazzi and Sa (2005) state that there are two main forces behind the large US current account deficits: an increase in the US demand for foreign goods and an increase in the foreign demand for US assets. They build a model based on the assumption of imperfect substitutability in both goods and assets markets, trying to understand the possible developments of the present scenario. They claim that their model provides a natural interpretation of the recent past, explaining the exchange rate movements of the main World currencies. They forecast a further depreciation of the dollar at a small steady rate in order to adjust the US current account deficit.

[5] The issue of sterilization is a result of reserves accumulation, since it leads to an expansion of the money supply (with dangerous inflationary consequences), unless monetary authorities sterilize the excess liquidity.

However, the exercise of forecasting is very difficult, since it relies on many assumptions on uncertain factors, such as the willingness of international investors to continue to finance the US deficit, its rate of reduction, the evolution of the World interest rates... However, a number of different models predict a further depreciation of the dollar. For instance, Obstfeld and Rogoff (2005) build a three region model, with Europe, USA and Asia, linked by trade and also by international assets and liabilities. Each economy can produce two kind of goods, tradable and non tradable. The key assumption of the model is that consumption preferences are home biased. The model tries to deal with all the factors that play a role in the international scenario: the speed of adjustment of the US current account and its triggers, the effects on European and Asian economies, the overall impact on exchange rates. In this framework, the current account is influenced both by the usual channel of the terms of trade effect and by a second real exchange rate effect, which is even more important. The model forecasts a further depreciation of the dollar to make the US deficit diminish significantly.

A number of authors do not study global imbalances with general equilibrium models such as the ones sketched above. Rather, they concentrate on some variables that are crucial to understand the problem. Public and private savings are certainly two of the more important variables on which economists have concentrated their studies.

2.2 The saving-investment perspective

Bernanke (2005) wants to confute what he calls the common view about global imbalances, namely that they are an American problem only. He says that international actions are needed in order to solve it, since the main causes of the problem lie outside the USA. He looks at savings, investments and international capital flows, concentrating on what he calls the "saving glut" of the last 10 years. The term refers to the high saving rates in several ageing developed economies and some developing countries. In the second half of the Nineties, some East Asian and oil exporter countries became net exporters of capitals, starting to accumulate large official reserves. Bernanke (2005) individuates three reasons for this accumulation: to create a buffer against outflows and crisis, to boost export-led growth and as a mere consequence of the rise in international oil prices. To adjust the imbalances, he proposes to act on two fronts. On the American side, a reduction of the federal deficit is needed (which, by the way, is not so important in the author's opinion – even if it amounted to 400 billion dollars in 2004, near to 4% of GDP). However, the real burden of adjustment should be carried by the developing countries, since they should reform their financial markets, liberalize and let the exchange rates move freely.

Some evidence against Bernanke's thoughts is brought by Chinn and Hito (2006). With an empirical analysis, they find that the government deficit is an important determinant of the current account balance, supporting the twin deficit hypothesis. Moreover, they find that a higher degree of financial development leads to higher savings, a finding that is not consistent with the "saving glut" hypothesis. However, the twin deficit argument has a major shortcoming, since the US current account deficit has been negative also during years of positive fiscal budgets (at the end of the Nineties).

Other authors have analyzed variables that carry broader information on savings, international assets and capital flows. Roubini and Setser (2004) concentrate on the US Net International Investment Position (NIIP), which is "the broadest measure of the amount the United States owes the rest of the world" (2004, p. 2). The NIIP has gone from negative 360 billion dollars in 1997 to negative 2,65 trillion dollars in 2003. Roubini and Setser (2004) call for immediate international cooperation in order to put an end to the global imbalances problem, before the variables reach unsustainable values that could lead to sharp and costly adjustments. They propose changes in both US and Asian policies, focusing on demand patterns and their consequences on exports and the NIIP. Again, they see a dollar depreciation as essential for the adjustment.

A similar point of view is taken by Gourinchas and Rey (2005a), which are not satisfied by the intertemporal approach to the current account. Following this approach, the only way to reduce deficits is to run surpluses in the future, because capital gains and losses on the Net Foreign Asset (NFA) position are not taken into account. This is a major shortcoming, since financial globalization has produced a sharp increase in gross cross holdings of foreign assets and liabilities and such portfolios heavily affect the international positions of countries through valuation effects. This deficiency depends on the fact that official statistics do not take into account the valuation effects, since most data are reported at historical costs. These valuation effects create an additional channel through which the USA can reduce the imbalance, different from future trade surpluses: a wealth transfer due to changes in returns on the NFA position (that may happen via a depreciation of the dollar). The authors build a new quarterly data set to find the US NFA position at market values and estimate that, historically, the valuation effects linked to depreciation eliminated 30% of external imbalances. Actually, this is a short-term effect of the dollar depreciation, while the long-term effect is the well-known trade channel. This happens because a depreciation of the dollar increases the value of US foreign assets but has no effects on the liabilities, since they are dollar denominated. Notwithstanding the importance of the valuation channel, the USA has an increasingly deteriorating NFA position, so that an interesting question arises: for how long foreign investors (both official and private) will continue to finance the US debt?

Gourinchas and Rey (2005b) try to answer this question by looking at the US "exorbitant privilege" that made it possible to produce the actual global imbalances. They call "exorbitant privilege" the following finding about the returns on the US NFA position. By analyzing further their new data set, they confirm the stabilizing effect of the valuation effect and its high correlation with the exchange rate. Moreover, by studying the returns of the gross positions, they find that the average total return has always been positive: US liabilities cost less than what is earned on assets. This explains why, despite a negative NFA position, the USA are able to gain positive yields on it, measured by the positive income account. This is the result of two diverse effects: a composition effect (US liabilities are mainly low yields safe securities, while assets are mostly FDI and equities) and a return effect (within each class of assets, US assets give rates of return that are higher than the interest rates paid on US liabilities). The authors try to estimate the tipping point, that is the moment in which the USA will start to experience negative yields, and they say that this moment will arrive soon. They say that the uncertainty surrounding the dollar exchange rate causes instability to the whole system, since a run on the dollar could be boosted by the fear of a sudden depreciation. This conclusion underlines the fact that the behaviour of the surplus countries' monetary authorities is not driven by purely economic motivations, since they are continually purchasing US securities with a apparent lack of care about these warnings.

The importance of public savings and foreign exchange reserves rises evidently from this brief overview of the studies on global imbalances. The next sections are devoted to the analysis of the phenomenon of reserves accumulation, with a review of the numerous studies that, since the Sixties, have dealt with the issue.

3. The early studies

Why do countries demand international reserves? And is it possible to assess their adequacy? The literature on this topic has developed since the Sixties, when the attention was gathered mainly by industrialised countries, the major owners of official reserves in that period. Under the Bretton Woods agreement, reserves were composed mainly by gold and did not reach impressive amounts. Then, during the Seventies and the Eighties, the demand for reserves changed, and the doctrine started to deepen the analysis of its determinants. In this section we will firstly present two important articles of the Sixties, then we will illustrate three key articles of the following two decades. These studies are important to understand the most recent ones, since they make use of the workhorse model of the subject, the buffer stock (or inventory) model.

Kenen and Yudin (1965) state that there is no way to measure the adequacy of reserves, even assuming that the main reason to accumulate them is to maintain stable exchange rates in the face

of payment disturbances. Their idea is to relate reserve holdings to the variability of external net receipts, that they proxy with the past changes of reserves. They model the demand for reserves as a function of national income (as a scale variable), national liabilities and the variability of receipts. Basically, reserves are seen as a buffer stock to accommodate fluctuations in external transactions.

Heller (1966), in his search for the optimal level of reserves, compares the opportunity cost of holding them and the cost of external adjustments that they help to avoid. He builds an index to try to condense all the factors that influence reserves accumulation, in which the propensity to import plays a significant part. This importance derives from Keynesian models of the adjustment mechanism (of the level of output), that suggest that for given reductions in export earnings the cost of not having reserves is inversely related to the relative size of the foreign trade sector.

It is worth to spend some words on the opportunity cost here. Theoretically, it should be measured as the differential between the social rate of return on capital and the return, if any, on the liquid international reserves held. However, social rate of return estimates are difficult to produce, thus the opportunity cost has always been proxied with long term interest rates. We will return on this important topic in subsection 5.2.

Frenkel (1974) builds a buffer stock model that relies on the price-adjustment theory, which predicts reserve holdings to depend positively on the degree of openness. Moreover, he recognizes that the behaviour of developed countries is substantially different from that of the less developed countries (LDCs). Several reasons justify this:

• transaction motives: different import elasticity of the demand for reserves (the lack of economies of scale for LDCs with less developed financial systems causes a higher need of reserves);

• asset motives: LDCs need more reserves for their increasing demand of money supply to sustain the growth process;

• different governments behaviour (higher probability of non-liberal measures in LDCs that allow for lower levels of reserves);

• differently developed capital markets (higher need to cover imports with reserves for LDCs, that suffer from a limited access to international capital markets).

Frenkel uses the following model:

$$R = Am^{\alpha_1}\sigma^{\alpha_2}M^{\alpha_3}$$

where the demand of reserves, R, is the dependent variable; the explanatory variables are the average propensity to import, m, the variability of international receipts and payments, σ, and the

level of imports, *M*. The estimates show that these three variables all have positive effects on the demand for reserves, even if the major point of Frenkel's analysis is that the results change depending on the level of development of the countries examined. The importance of this last finding has been widely recognized, since all the subsequent research focuses either on industrialised countries or on developing countries. Note that the author does not include a measure of the opportunity cost, admitting that he could not find a satisfactory measure for it.

Frenkel and Jovanovic (1981) summarize the earlier findings by developing a theoretical model of the demand for reserves with two main variables: the variability of payments and the market rate of interest, to mimic the opportunity cost. This buffer stock model has become a milestone in this field, being still used with only minor modifications.

They hypothesize that reserves movements between occasional restockings are generated by an exogenous random walk process. The stochastic equation governing the changes in reserve holdings is the following:

$$dR(t) = -\mu dt + \sigma dW(t); \quad R(0) = R_0, \mu \geq 0$$

where *W(t)* is the standard Wiener process with mean zero and variance *t*. The changes in reserves are normally distributed until reserves hit the lower boundary zero, when, in a one step adjustment, reserves go back to their optimal level and starts to move again following the Wiener process. Developing a theoretical model they also write the formula of the optimal level of reserves, that minimizes their expected cost. It is the following:

$$R_0 = \sqrt{\left[\frac{2C\sigma^2}{\left(\mu^2 + 2r\sigma^2\right)^{\frac{1}{2}} - \mu}\right]}$$

where *C* is the one step adjustment cost and *r* is the percentage cost of holding reserves per unit of time. Their empirical estimates of the model on a panel of 22 developed countries yield good results (the explanatory power of the model is very high and all significant coefficients are of the expected sign).

Edwards (1983) adds another factor that must be taken into account when studying reserves accumulation: the exchange rate regime. Countries with floating rates are willing to use exchange rate adjustments to correct international payments difficulties, so they behave differently from

those that have ruled out the exchange rate as a policy tool. The idea is that the first type of countries can hold less reserves as buffer stocks to finance payment problems. In order to find empirical support for this idea, the author uses the following econometric model to test the importance of the variability of external payments (σ), of trade openness (m, average propensity to import) and of a scaling variable (Y, national income):

$$\log R_n = b_0 + b_1 \log Y_n + b_2 \log m_n + b_3 \log \sigma_n + u_n$$

The equation is estimated separately for the two groups of countries, concluding that they should not be pooled, since fixed exchange rate regime countries care about the variability of payments, while the others do not. This result led to the recognition that "...the decisions about reserve holdings and exchange rate adjustments should be viewed as being simultaneously determined endogenously" (Edwards, 1983, p. 277).

This opened the way to the use of this additional variable in following studies about reserves accumulation. However, the Eighties saw a decreasing attention on this topic because of the pervasive belief that reserves were going to be a stable phenomenon. The recent rise of their level produced a new wave of studies on reserves accumulation, that mostly rely on the models and the early empirical results that I have illustrated so far.

4. The new studies

Since the second half of the Nineties, World official reserves have recorded incredibly high rates of accumulation. Flood and Marion (2002) offer an interesting reasoning that seems to question the rationality behind this observed pattern. According to the assumption that reserves are needed if and only if countries are willing to intervene in the foreign exchange markets in order to manage their currencies, the need for reserves is declining because of the increasing adoption of flexible exchange rate regimes all over the world. But, reserves are rising at extraordinary rates, especially because of the behaviour of some Asian countries (China, Japan, Russia, Taiwan, South Korea and India currently are the six largest holders). However, a possible explanation for this incongruity is offered by Calvo and Reinhart (2002). They analyze 154 exchange rate arrangements, showing that what they label as "fear of floating" is making the de facto exchange rates very different from the de jure ones: officially floating rates are in fact heavily managed and pegged to other currencies. Assuming that this analysis is right, countries still need to accumulate reserves to manage their exchange rates, thus there are rational reasons behind the hoarding of reserves that need to be studied and understood.

About the sustainability of the actual rates of accumulation, Pineau and Dorrucci (2006, p. 8) are clear: "reserves accumulation in most countries has gone beyond the levels warranted by conventional indicators, suggesting that the build-up is largely influenced by other factors. Three of the fundamental drivers of reserves accumulation, all of which are in some way related to financial globalisation, stand out in addition to the more recent oil price hike:

1. A desire to self-insure against financial crises (virtually all EMEs – Emerging Market Economies - share this motivation, although this is expected to loose importance as accumulation progresses);

2. The pursuit, at least during certain periods (e.g. following a financial crisis), of export-led growth by a number of Asian economies, supported by exchange rates anchored to the US dollar;

3. The combined effect of a number of features related to the financial structure of several EMEs, including underdeveloped domestic financial systems and dollarisation of foreign assets in certain net creditor Asian economies."

While most economists would have nothing to object against the third point, the other two points are at the centre of a currently open debate. Dooley et al. (2005), the creators of the Bretton Woods II model, think that the Asian countries are accumulating foreign exchange reserves to keep their exchange rates undervalued and pursue an export-led growth (mercantilist reasons for reserves accumulation), while other scholars, such as Aizenman and Lee (2007), provide evidence towards a bigger importance of precautionary motives. The following review of recent studies will clarify the results that the literature has reached.

An article by Lane and Burke (2001) is useful to see why the early literature maintains its importance even at present. The authors investigate the determinants of reserves accumulation using a large sample of countries (more than 100) with a very generic econometric model:

$$\log \frac{RES_i}{GDP_i} = \alpha + \beta Z_i + u_i$$

where Z is a vector containing a set of variables suggested by the previous theories and empirical evidence. The results confirm the importance of some of the explanatory variables of the basic buffer stock model, such as trade openness. New variables, such as financial deepening, are also found to significantly affect reserves demand. Moreover, some of the words of the authors proved to be prophetical: "it is reasonable to believe that the determinants of reserves are evolving: in the wake of the 1990s crises, growing prominence is likely to be given to the scale of short term

external liabilities in determining the appropriate level of reserves" (Lane and Burke, 2001, p. 433).

Flood and Marion (2002) perform a very detailed analysis to try to understand the reasons of the recent hoarding of reserves, with the buffer stock model as a guide. The authors say that even if three new trends have had effects on reserves accumulation (increasing capital mobility, high frequency and intensity of currency and financial crises and a widespread switch to flexible exchange rates), the old buffer stock model performs incredibly well when estimated with recent data. With a long descriptive analysis, they also illustrate some surprising patterns of the data. For developed countries, even if the ratio of reserves over GDP increased in the last years, other indicators go in the opposite direction. For instance, reserves including gold as a share of weeks of import cover are lower now than they were in 1960. On the contrary, reserve holdings of developing countries have increased over the last three decades, whether scaled by income or imports, but have not changed much when scaled by money supply.[6]

To study the determinants of accumulation, they firstly replicate the results of Frenkel and Jovanovic (1981), then they apply some new ideas to overcome a possible bias due to the construction of the original stochastic model. In particular, they recognize that the process of adjustment of reserves seems to be a mixture of typical increments plus some sort of endogenous jump process (associated with speculative attacks and macro-policy changes) and they use the shadow exchange rate to take this fact into account. They estimate the following model:

$$\log\left(\frac{R_t}{X_t}\right) = \beta_0^i + \beta_1 \log\left(\frac{SigF_t}{X_t}\right) + \beta_2 \log\left(i_t\right) + \beta_3 \log\left(SigS_t\right) + \beta_4 \log\left(\frac{F_t}{X_t}\right) + u_t$$

where R is the level of reserves; X is a scaling variable; $SigF$ is the volatility of the shadow rate fundamental; i is the opportunity cost; $SigS$ is the volatility of the effective exchange rate; F is the level of the shadow rate fundamental.

However, even if the construction of the model is clever and very well explained, their attempt to model the process of reserves accumulation does not yield convincing econometric results. In particular, their regressions leave most of the explanation to country-specific effects and find no effects for theoretically important variables such as the opportunity cost (possibly because of the use of a poor proxy) and the exchange rate regimes.

[6] Cheung and Wong (2007) dedicate a whole article to the issue of how to measure international reserves. They analyze seven different ratios used in the literature, to find that in many cases the rankings of the largest holders depend on the scaling variables. They also find a high degree of cross-economy variability, even if there are discernable patterns related to different country structural characteristics.

The recent works are not confined to new utilizations of old models and theories. Taking into account the recent international developments, some authors have built theoretical models that attribute to reserves accumulation positive properties of smoothing out the negative effects of financial crises. In the last twenty years, many developing countries have increased their participation in financial markets, thanks to massive liberalizations accompanied by big increases in international capital flows, especially in East Asia. These new developments have slowed, and even stopped, during the Nineties, when some countries have been hit by a new kind of financial crises, a fact that immediately led economists to build new models in order to highlight the importance of the new mechanisms at work in this kind of events (see Eichengreen, 1999, for a review). Together with bad policies followed by governments, international capital flows and financial market operators acquired importance in the scenario. In this framework, a growing importance has also been recognized to foreign exchange reserves because of their possible role in counteracting the negative effects associated with sudden stops and current account reversals. Besides theoretical considerations, this is related to the fact that the East-Asian crisis was more severe in countries with lower reserves with respect to the neighbours (Fischer, 1999). In this respect, Feldstein (1999) writes a "self-help guide" for emerging markets. Starting from the consideration that crises can not be completely avoided by any international architecture or supranational authority, he says that countries need self-protection in order to lower their vulnerability from financial instability. Besides sound policies, self protection should be based on liquidity, because of the lack of an international lender of last resort. Moreover, liquidity is needed long before the crisis occurs. In this regard, exchange rate policies play an important role, and flexibility seems to be a better choice with respect to pegged exchange rates. The author lists four different causes of a crisis and argues that a high level of liquidity could solve the problems associated with every one of them. He suggests three steps to achieve it:

• to avoid high short term foreign debt (even with the adoption of Chilean-style controls on capital inflows);

• to accumulate large foreign exchange reserves (although this is costly in two different ways: the needed positive net exports require cuts in domestic consumption and investments; there is an opportunity cost, even if new and riskier strategies of reserve management are possible and, indeed, already in force somewhere);

• to create a collateralized loan facility.

These ideas lead us to the recognition of a main order of reasons to hold official reserves: the so-called precautionary motives, that reflect the desire for self insurance against exposure to sudden stops. This view suggests a reason for accumulation additional to the mercantilist one, that sees

accumulation as triggered by concerns about export competitiveness only and concentrates on the use of reserves to manage the exchange rates (Dooley et al.,2005).

Aizenman and Lee (2007) analyze these two orders of motives both from a theoretical and an empirical point of view. They start with a consideration about the East Asian countries, claiming that the 1997 crisis is the cause of the recent massive build up of reserves, something that suggests that the precautionary motives are the main explanation for the accumulation. They perform an econometric estimation using the usual buffer stock model (with population, imports over GDP, exchange rate volatility and per capita income as controls), with the addition of some more variables to be able to quantify the importance of the two different orders of reasons. To quantify the mercantilist motives, they add the growth rate of real exports and the fundamental PPP real exchange rate; to grasp the importance of precautionary motives, they use dummies for the 1994 Mexican and the 1997-98 East-Asian crises.

For a sample of 53 countries, both developing and developed, they find that both the mercantilist-related and the precautionary variables significantly affects reserves accumulation, but only the first are quantitatively important. However, the results are not totally satisfactory, since the variables that are found to be significant appear only in the very final part of the sample period, that goes from 1980 to 2000. Moreover, the results hold even for China, often blamed for its interventions in the currency market to keep the value of the Renminmbi stable and undervalued with respect to the dollar. In fact, the main part of the article is the one illustrating a theoretical model capable to quantify the welfare gains from optimal management of international reserves for precautionary reasons, using the simple structure derived from Diamond and Dybvig (1983). The model is used to describe an investment in a long term project that should be undertaken prior to the realization of liquidity shocks. They derive the following first order condition for the optimal deposit:

$$\left[MP_{K_1} - \left(1 + r_f\right) \right] * \Pr\left[Z < R \right] = \theta E\left[MP_K \mid Z > R \right]$$

where MP_K is the marginal productivity of capital, r_f is the return on reserves, Z is a liquidity shock in the economy, R is the level of reserves and θ is the adjustment cost.

The results show that holding reserves has first order welfare effects because it reduces the cost of liquidity shocks, if below a certain level. The model is also able to predict an optimal level of reserves. The basic version of the model is contained in an article by Aizenman and Marion (2004), together with a simple empirical analysis carried out with the buffer stock equation. Interestingly, political economy considerations are put into the analysis in order to understand their

consequences on the behaviour of the governments. The authors start from the following question: does the increase of the cushion of international reserves benefit every country in terms of higher perception of their safety as borrowers (from a similar point of view, Detragiache et al., 1996, build a different model in order to explain why a country with large official reserves is more creditworthy)? They enrich the buffer stock model with the volatility of the exchange rate (from Edwards, 1983) and the following political variables: probabilities of government changes by both constitutional and non constitutional means and an index for political corruption. All the regressions yield good results and all the variables apart from export volatility present significant and expected coefficients. However, some important features, such as the impact of access to international borrowing, remain out of the analysis.

Building on these results, Aizenman and Marion (2003) concentrates on the behaviour of some Asian countries. They firstly estimate the following, standard buffer stock equation:

$$\log \frac{R_{i,t}}{P_{i,t}} = \alpha_0 + \alpha_1 \log(pop_{i,t}) + \alpha_2 \log(gpc_{i,t}) + \alpha_3 \log(exa_{i,t}) + \alpha_4 \log(imy_{i,t}) + \alpha_5 \log(neer_{i,t}) + \varepsilon_t$$

where R is reserves holdings scaled by P, the GDP deflator, *pop* is the population, *gpc* is GDP per capita, *exa* is the volatility of real export receipts, *imy* is the share of imports over GDP, *neer* is the volatility of the nominal exchange rate. The results show that the equation correctly estimates the demand of reserves for the period prior to the East Asian crisis, but then underpredicts it for East Asian countries, suggesting the importance of precautionary motives dictated by the fear of sudden stops and financial crises. Accordingly, the authors build a model calibrated on a developing country, showing that political instability, high discount rates and political corruption are factors that can reduce the demand for reserves (for a related application, see Alesina and Tabellini, 1990). This analysis helps understanding why only some developing countries are accumulating large reserves, while others are not.

Still on precautionary holdings of reserves, Aizenman and Riera-Crichton (2006) analyze the reserves effects on the mitigation of the terms of trade (TOT) shocks on the real exchange rates. The specification here is different, since the model has a different dependent variable:

$$\log\left(REER_{i,t}\right) = a_{1,i} + \alpha_1 \left(TO * \log\left(TOT\right)\right)_{i,t} + \alpha_2 \left(\left\{TO * \log\left(TOT\right)\right\} * RES\right)_{i,t} + \varepsilon_{i,t}$$

where *REER* is the real effective exchange rate, *TO*ln(TOT)* is the effective terms of trade, *RES* is foreign exchange reserves scaled by GDP. The econometric results are not crystal-clear, since a high level of significance is obtained for Asian countries only. However, the overall conclusion seems to imply that reserves can mitigate the volatility effect induced by TOT shocks on capital flows, which in turn affect real exchange rates, helping in counteracting possible sudden stops. This suggests an additional channel through which official reserves can benefit developed countries.

Aizenman and Glick (2008) well summarize the findings on precautionary motives. The authors believe that this recent hoarding of reserves is the result of a new solution chosen by Asian countries to solve the famous macroeconomic trilemma, that states that "a country may choose any two, but not all, of the following three goals: monetary independence, exchange rate stability and financial integration" (Aizenman and Glick, 2008, p. 3). Reserves accumulation is a key ingredient of the new mix of financial integration, monetary independence and still managed exchange rates, but there are growing concerns due to the sterilization policies that are needed to support the accumulation. In their article, the authors perform an econometric analysis to estimate the degree of sterilization performed by some countries with a simple equation:

$$\frac{\Delta DC}{RM_{-4}} = \alpha + \beta \frac{\Delta FR}{RM_{-4}} + Z$$

where *DC* is net domestic credit, *RM* is reserve money stock, *FR* is net foreign reserve and *Z* is GDP growth. Full sterilization occurs if β is equal to minus one, since in this case the central bank would allow domestic credit to accommodate fully higher demand for money due to GDP growth, but would prevent any domestic credit expansion due to hoarding foreign reserves. Even if they conclude that sterilization has been an effective strategy so far in most of the countries of the sample (China, Korea, Thailand, Malaysia, Singapore, India, Argentina, Brazil and Mexico) , they add that it is distortionary and costly. Moreover, it can become ineffective when the influx of capital is persistent and large.

There are other authors that studied the phenomenon of reserves accumulation looking at precautionary motives. For example, Jeanne and Ranciere (2005) build a model assuming reserves to be the result of an explicit intertemporal objective function of the government willing to smooth domestic absorption in response to crises.

The government maximizes:

$$V_t = \sum_{s=0,\ldots,+\infty} \left(1+r^*\right)^{-s} v\left(A_{t+s}\right)$$

subject to:

$$R_t + Z_t + \left(1+r\right) D_{t-1} = \left(1+r^*\right) R_{t-1} + D_t$$

where *r** is the world short term interest rate, *A* is domestic private absorption, *R* is reserves holdings, *D* is government debt and *Z* is a transfer to the private sector that can be either positive or negative (taxes). They hypothesize that reserves can have positive effects both to achieve consumption smoothing and to lower the probability and the magnitude of crises. Interestingly, the authors explicitly take into account the mercantilist motives advocated by Dooley et al. (2005). In that case, their "...approach would simply tell what fraction of the total reserves can be rationalized in terms of insurance. The unexplained residual (...) should be held in less liquid but higher yielding assets, following a logic closer to portfolio management than liquidity demand" (Jeanne and Ranciere, 2005, p. 1). Thus, as it is the case in Aizenman's studies, it seems that the two different views about the reasons for hoarding reserves could be interpreted as two different parts of the same picture. Jeanne and Ranciere (2005) also estimate the optimal levels of reserves, concluding that they are consistent with the observed levels of the analyzed countries, suggesting that the high levels reached are consistent with the risks posed by the actual international financial scenario.

Choi et al. (2007) confirm the importance of precautionary motives with an empirical investigation about the link between capital flows and reserves accumulation. They use a buffer stock model similar to Aizenman and Marion (2004), enriching it with sovereign ratings and capital flows. Their results show that in developing countries there is a positive relationship between this last variable and the demand for reserves, suggesting that capital inflows have been used to build large reserves because of heightened concerns about the risks of sudden stops and the loss of access to international capital markets.

Garcia and Soto (2004) combine two strands of literature to study precautionary motives in an original way: the strand on early warning systems for crises and the one on reserves demand. Their hypothesis is that accumulating reserve reduces the likelihood of speculative attacks, even after controlling for institutional aspects such as political institutions quality and financial institutions soundness. Basically, instead of being a buffer stock, reserves are seen as a tool to reduce the incidence of international crises. They use the following logit model:

$$p_{i,t} = p\left[\beta_0 \frac{R_{i,t}}{S_{i,t}} + \beta_1 \frac{D_{i,t}}{Y_{i,t}} + Z_{i,t}\gamma - \varepsilon_{i,t}\right]$$

where p is the probability of a crisis, R is reserves, S is short-term debt, D is total debt, Y is GDP and Z is a set of additional controls. The sample is constituted by some Asian developing countries and Chile for the period 1975-2003, and simulation are performed in order to calculate the optimal level of reserves to avoid a crisis (using the framework by Ben-Bassat and Gottlieb, 1992). Results turn out to depend on the assumptions made on the costs of it, but in the end the two authors conclude that the analyzed countries are holding the right amounts of reserves for the hypothesized purpose.

Another interesting study is the one by Terada-Hagiwara (2005). He does not perform an empirical investigation, nor he builds a theoretical model to study reserves accumulation. Rather, he performs a deep descriptive analysis of the data. Starting from the consideration that the main reason to hold reserves is to smooth temporary imbalances in international payments, he points out that several studies show that reserves have overcome the optimal levels suggested by economic theories (for example, the Guidotti-Greenspan rule[7]). He analyzes the issue from the point of view of sustainability, saying that many Asian countries did not choose a corner solution of the trilemma, because they chose managed exchange rates together with some capital controls. As Aizenman and Glick (2008), the author questions the sustainability of such regimes, due to the problems arising from the interaction of important macroeconomic variables such as money supply, exchange rates and inflation. In particular, he looks at the issue of sterilization in China and India. His conclusion is that sterilization interventions have been successful in the short run, but in the long run Asian countries need to adequate their regimes and policies to be less vulnerable to shocks. This point is emphasized by Roubini (2007) for the case of China. Suggesting the Chinese authorities to abandon the actual dollar peg, he warns against the dangers of an exchange rate kept undervalued thanks to the accumulation of reserves. Additionally to the sterilization costs, he lists the risk of inflation and possible capital losses due to future revaluation. However, many points are unclear. For example, Roubini (2007) writes that Chinese the sterilization rate has been only 70% of the intervention flows, without saying how he calculated such a value that goes against the evidence provided by other studies (for instance, Aizenman and Glick, 2008).

[7] In a few words: ...the rule that countries should hold liquid reserves equal to their foreign liabilities coming due within a year, Rodrik (2006), p. 5.

The final part of this section is devoted to an additional interesting hypothesis that justifies the recent precautionary accumulation of reserves. The idea is that non-related-to-fundamentals factors are playing a role in the hoarding of reserves in East Asia. In particular, the accumulation could reflect a competition among countries, either to preserve the market shares with the USA and other OECD countries (Aizenman and Lee, 2008), or to signal a better resistance to crises with respect to the neighbours (Cheung and Qian, 2007). The second hypothesis is especially attractive, since it seems consistent with the observation that economies with a higher level of international reserves survived the East Asian financial crisis better than those with a lower level, suggesting that countries with relatively higher reserves had been able to divert the speculative pressure to the neighbours. Accordingly, Cheung and Qian (2007) build a model that takes into account this additional effect of holding reserves, elaborating the original idea by Machlup (1966). In the second part of their work, they also present empirical evidence in support of their theories, for a sample of 10 Asian countries in the period 1980-2004. They estimate the following model:

$$Y_{i,t} = c + X_{i,t}^{'}\alpha + \delta J_{i,t-1} + \psi I\left(t-1>97\right)*J_{i,t-1} + \varepsilon_{i,t}$$

where Y is reserves over GDP, X is a vector of the traditional variables of the buffer stock model (per capita output, trade openness and financial openness), J is the variable that captures the hoarding competition, with an additional term to see if the 1997-98 crises has changed the behaviour of the countries in the sample. Both with panel level regressions and with economy-by-economy estimations, the results support the notion that an economy's international reserve demand behaviour is affected by other economies' action.

The studies summarized in this section demonstrate how the analysis of international reserve management can be interesting and challenging at the same time. Additionally to reasons based on the economy's fundamentals, such as exchange rate regimes, trade openness and institutional factors, the recent evidence shows that the new developments of the international markets have led to changes in the behaviour of national authorities. Nowadays, the accumulation of reserves seems to be driven also by precautionary and mercantilist motives, together with other considerations such as the actions of the other competitor countries.

5. Two open issues: the opportunity cost and the issue of currency diversification

5.1 The opportunity cost

Holding reserves is costly: the interests earned on official reserves are usually very low, given their nature of extremely liquid assets. In order to reduce the costs of holding large quantities of reserves, some countries started to manage their reserves more actively. For example, Singapore established the Singapore's Temasek/GIC, a sort of hedge fund with the task to manage part of the official reserves for returns reasons (Pineau and Dorrucci, 2006). Some oil exporting countries have stabilization funds that act similarly to private investors, while China is starting to use some commercial companies in an analogous way (Jen, 2006a and 2006b, Pan and Junbo, 2008). Basically, since reserves are reaching very high levels, some countries are keeping a large part of them for liquidity and safety objectives, but they are using a smaller part (the part "in excess") to increase both the long term value and the rates of return. In this respect, Claessens (2004) proposes a strategic risk management capable to combine the risk-returns objective with the prudential and sovereign debt management concerns.

However, abstracting from these new and still not general developments, holding reserves implies high opportunity costs, additional to the negative effects of the distortions introduced in the economy via sterilization interventions and the effects on the exchange rate. Still, it is rare to find empirical evidence of the importance of this opportunity cost. A short article by Ben-Bassat and Gottlieb (1992) is particularly adapt to clarify why this is the case.

The authors begin their study by saying that the demand of foreign exchange reserves is usually analyzed with a cost-benefit approach: reserves make it possible to bridge unexpected gaps of the net flow of foreign currency, but are costly, since their returns are low. Theoretically, this opportunity cost is the difference between the highest possible marginal productivity forgone from an alternative investment in fixed assets and the yield on international reserves. The importance of this variable is widely recognized, but most empirical studies only include proxies, due to the lack of appropriate data (see Wooldridge, 2006, on that). Ben Bassat and Gottlieb (1992) have this kind of data for Israel, thus they analyze this country to test the empirical importance of the "right" opportunity cost. They define it as the difference between the maximum between the real return on capital and the yield of public projects, and the yield on reserves (real interest rate on short term deposits in dollars and marks, given their weights in the reserves' currency composition). The model used is taken from Frenkel and Jovanovic (1981):

$$\log R_t = b_0 + b_1 \log \sigma_t - b_2 \log r_t + u_t$$

but, contrarily to the original study, the coefficient of the opportunity cost, *r*, is found to significantly affect reserves demand. Moreover, it is of bigger importance than the one associated with the variability of the balance of payments. This finding suggests that the results of the econometric estimations about reserves could vary substantially utilizing of more accurate data.

Rodrik (2006) uses a different concept of opportunity cost, the social cost of reserves. He firmly believes that precautionary motives are the explanation of the rapid accumulation of foreign exchange reserves of the last years in developing countries. Following Feldstein (1999), he states that the best way to achieve the liquidity necessary for self insurance would be to reduce the short term debt. However, most countries have chosen to pursue this objective by accumulating reserves. He then tries to assess how costly is this strategy. He defines the opportunity cost as the spread between the private sector cost of short term borrowing abroad and the yield that the Central Bank earns on its liquid foreign assets. It is clear that this cost is different both from the fiscal cost of holding reserves (spread between the interest on domestic government bonds and the yield on reserves) and from the opportunity cost related to the alternative use of the capital with public investment. The social cost concept used by Rodrik does not treat as relevant one possible additional dollar of public investment, but one dollar less of short term debt. He also excludes from the computations the amount of reserves required to satisfy the three-months of imports covered rule (which was the rule of thumb followed by most developing countries before the Nineties crises period). However, due to the lack of data about short term borrowing conditions, the author uses three different values to proxy the spread in his calculations. The results of the analysis are that developing countries are paying a cost that Rodrik judges to be high but fair, if compared with the significant costs of being illiquid in case of crisis. But, he adds that this strategy is far from being optimal, since in most countries short term debt is continually growing, in conflict with the aim of reaching a high level of liquidity. As Feldstein (1999), Rodrik suggests Chilean-style capital controls in order to reduce short term debt.

Starting from a similar reasoning about liquidity, Alfaro and Kanczuk (2007) build a stochastic dynamic general equilibrium model to study the joint decision of holding sovereign debt and reserves. The model is a modification of Aguiar an Gopinath (2006), and the authors perform some calibrations to be able to make some judgments on the behaviour of the emerging economies that are currently accumulating large reserves. Even if they attribute positive properties to reserves holding, they find that the optimal policy would be not to hold reserves at all.

This result confirms once again that scholars are puzzled by the actual behaviour of countries, that is, national authorities seem to operate following political economy considerations more than pure economic theory. Alternatively, it should be recognized that there are some disturbances that lead to sub-optimal actions.

The article of Hauner (2006) about the costs of reserves is particularly interesting . The author proposes a conceptual framework to measure the impact of the cost of reserves, taking into account four different elements:

- the opportunity cost (foregone return from alternative uses);
- the fiscal gains/losses on reserve assets (returns and appreciation/depreciation);
- sterilization costs;
- lower government interest bill (if negatively correlated to interest rate spreads).

Their combination yields the net fiscal cost of international reserves, *C(R)*:

$$C_t\left(R_t\right) = \left(\max\left\{r_t^e, r_t^{kG}\right\} - d_t r_t^S - d_t - \beta D_t\right) R_t + S_t^{t-j}$$

where r^e is the interest rate on external debt, r^{KG} is the return on government capital stock, $r^{\$}$ is the foreign currency rate of return, d is the depreciation rate, D is the stock of external debt and S is the cost of sterilization. Then, this cost is estimated for a sample of 100 countries in the period 1990-2004. This application shows that most countries were making money out of their reserves during the Nineties, but in 2002 they started recording losses. However, it is possible that this result is mainly driven by the depreciation of the US dollar (that only recently started to appreciate again), since the author writes (p. 180): "the estimated *revaluation gain* (…) is the most important driver of the total net cost of international reserves, due to frequently large exchange rate swings". In a long term perspective, and assuming that this depreciation has only been a temporary phenomenon, this is a cost that is probably not fully considered by the managers of foreign reserves. Moreover, there is the possibility that more recent data can show the non-uniqueness of the 2002 turning point. However, Hauner's attempt to build a systematic method to calculate the effective cost of foreign exchange reserves, remains a good innovation in the literature on the subject.

5.2 The currency diversification problem

So far, the currency composition of reserves has been left out of the analysis. An interesting article by Eichengreen and Mathieson (2000) is helpful to introduce this topic. The authors start from the consideration that, despite its importance, this is an understudied aspect of the international

monetary system. During the Nineties, big changes happened both on the supply and the demand side of the financial markets. On the supply side, the advent of the Euro has created a fully-fledged rival to the dollar for the first time since the end of World War II. On the demand side, several developing countries acquired an increasing economic importance. The extraordinary part of the work by Eichengreen and Mathieson (2000) is that the authors use unpublished confidential data, bypassing the usual problem of this kind of studies: the lack of official and reliable statistics. They study the currency composition of reserves for 84 emerging economies, starting from a benchmark model with three explanatory variables: the existence of a currency peg, debt service payments and external trade with a reserve currency country. They successively add other variables, such as an index to grasp the importance of capital transactions liberalization (using the IMF Exchange and Trade Restrictions annual[8]), and interest rates as proxy for the opportunity cost.

The results are that the currency composition of international reserves is influenced by the three key explanatory variables utilized, even if there is a high degree of inertia. Additionally, the authors study two more issues: the demand of gold and the precautionary motives for holding reserves.[9] They have an interesting opinion about the latter: countries should not hold large reserves as an insurance device against capital outflows, since the best solution to achieve liquidity is to limit external debt (in line with Feldstein, 2008, and Rodrik, 2006). They think that reserves would be in any case too limited to be able to counter sudden stops and current account reversals. It is important to point out that this paper was written in 2000: the authors could not know about the dramatic rise in international reserves that was starting that year. More recent studies are illustrated below, to understand if something changed in the years following the financial crises of the Nineties.

Papaioannou et al. (2006) focus their attention on the role of the Euro as a share currency in international reserves. This is a very interesting issue, since the differentiation of official reserves in favour of the Euro could affect the international exchange rates, the demand for US securities and, consequently, global imbalances. The authors say that both theory and an empirical investigation of the data suggest inertia in reserves management (confirming the conclusions by Eichengreen and Mathieson, 2000). Also, the major role of the dollar as the main reserve currency is out of question. They study reserves accumulation with a dynamic mean-variance currency portfolio optimizer (based on the Capital Asset Pricing Model) that they claim to be used by many Central Banks at least for some parts of their reserves:

[8] However, this index is not totally reliable. The problem is that it takes into account the de jure controls and restrictions, without any attempt to match them with the de facto measures. This is highlighted in several studies about capital controls when they are analyzed for their effectiveness (for example, see Magud and Reinhart, 2005).

[9] In 1999, the demand for gold required attention after the agreement among several Central Banks not to sell it in order to preserve its value, but nowadays it seems to be less attractive.

$$\max_{wi,wf} E_t\left[R_{t+1}\right] = \sum_{i=1}^{I} w_{i,t} E_t\left(r_{i,t+1}\right) + w_{f,t} r_{f,t+1}$$

where R is total returns, w_i is the share of currency i in the portfolio, r_i is the return on currency i, f is the return free asset. The maximization takes into account three different constraints, that reflect the behaviour of central banks: for example, one assumption is that they do not take short positions in any currency. Moreover, Central Banks must constantly satisfy a certain need for liquidity, and they also need to hold the currencies of the most important trading partner, as well as the one in which external liabilities are denominated.

The results of the model for a representative central bank are that the optimal share of US securities is different from the actual ones of several countries (and these results hold for various assumptions on the preferences about variances and returns of the assets). Furthermore, a part of the study is devoted to four large developing countries, important holders of reserves: Brazil, Russia, India and China. According to the model, all of them, with the exception of China, should hold more Euros in their reserves in order to optimize the composition. Other analyses lead to similar conclusions. For instance, Eichengreen (2005) performs an analysis from a historical perspective to state that the status of dominant reserve currency can change and, also, can be shared by more than one currency at the same time. His forecast is that, by 2015, the dollar and the Euro will be two equally valued reserve currencies, because "sooner or later foreigners will grow reluctant to hold more" of the growing US debt (Eichengreen, 2005, p. 17). Chinn and Frankel (2006) put this statement to a test with their econometric analysis of the reserves currency shares. However, their forecasts depend on subjective assumptions on the US macroeconomic policy and the other countries' confidence in the value of the dollar, therefore the conclusions are not crystal clear.

To conclude this section on currency diversification, an article by Truman and Wong (2006) is now presented. It is a proposal to adopt an international reserves diversification standard in order to reduce the volatility of foreign exchange and financial markets. This would allow to mitigate the negative effects induced by rumours about large scale international reserves diversification. The authors call for international cooperation, since they claim that a collective action could overweight the costs suffered by single countries. Two elements would be required for the adoption of the proposed standard: higher transparency about the composition of reserves (to be achieved with periodical communications to the IMF of higher quality of what is currently done) and a commitment to adjust gradually to any new benchmark for the holdings. The adoption of

such measures would reduce the risks posed by active reserves management that could potentially shift large amount of resources from one currency to another, causing turbulence in the international market. However, the authors claim that concerns about active reserves diversification might be exaggerated. In particular, they believe that the role of the official sector in providing external finance to cover the US current account deficits has been overstated by many authors (such as Roubini and Setser, 2005), since private investors still matter more than official ones. Additionally, since inertia has always been a characteristic of reserves management, it is unlikely that in the future there will be large variations in the currency composition of large quantities of official reserves.

6. Conclusions

This survey deals with global imbalances and the closely-related aspect of foreign exchange reserves accumulation. Several aspects of the former are worth studying: the large US current account deficit, the role of savings both in and outside the USA, the rising World official reserves, the international capital flows. There is an open debate about the sustainability of global imbalances and their possible future developments: some economists have faith on the stability of the system, while others believe in the disorderly adjustment hypothesis, with different degrees of severity.

The overview of the debate on the sustainability of global imbalances starts with the Bretton Woods II and other models. Various different forecasts are implied by these alternative approaches. Then, a few studies that take advantage of the saving-investment perspective are presented. Both private and public savings crucially affect global imbalances. The former has declined in the USA, leading to the high current account deficits. The latter is the counterpoint of that, and has permitted to several Asian and oil exporting countries to accumulate US assets in their official reserves.

The second part of the survey illustrates the state of the literature on foreign exchange reserves. It begins with the early studies, that contributed to the construction of a solid benchmark for the analysis: the buffer stock model. Then, more recent studies are presented, from which two new orders of reasons for accumulating reserves are proposed: the mercantilist one, dictated by the need to keep the currency undervalued to pursue an export-led growth, and the precautionary one, according to which the main reason for the accumulation is the fear of sudden stops and financial crises. Also, political economy and institutional considerations often enter the analysis. The literature findings suggest that even if precautionary motives seem to be the most important determinants of the recent huge increase of reserves in developing countries, other factors play

non-negligible roles. For instance, the management of exchange rates seems to significantly affect reserves accumulation. Additional aspects such as the currency diversification possibility and the creation of new sovereign wealth funds are also sketched.

Several open issues are worth a further analysis, both from a theoretical and an empirical point of view. For example, the cross-asset diversification of the official reserves, that affects the reserves' returns, can change the way in which their costs are considered. More generally, studies that combine insights both from the theory and from the actual behaviour of national monetary authorities could be really motivating. It has to be recognized that one of the biggest issue of empirical analysis is the lack of highly detailed data. However, both countries and international institutions (especially the IMF and the BIS) are working to solve this problem, and further improvements in the quality of data can positively affect the research on official reserves.

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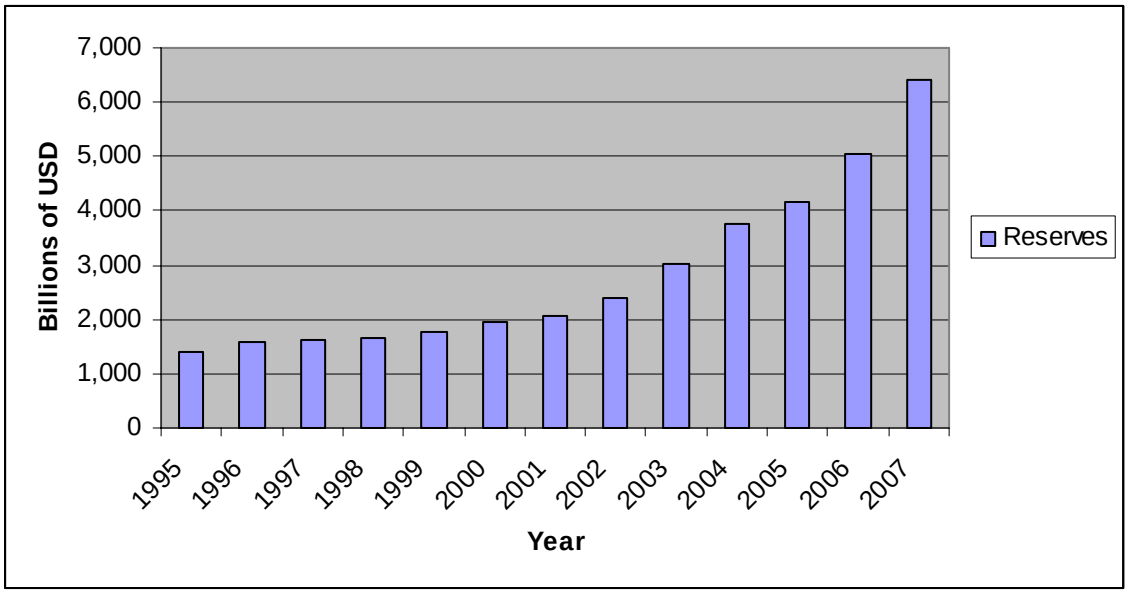
Figure 1: World foreign exchange reserves



Source: IMF, COFER

GLOBAL IMBALANCES AND HOUSEHOLD SAVINGS: THE ROLE OF WEALTH

Simone Salotti[÷]

Abstract

Many claim that fluctuations in US private savings help to create and to sustain global imbalances because of their influence on the current account deficit. To test this claim, this paper investigates the determinants of aggregate household savings using a panel of 18 developed countries for the period 1980-2005. We weave two strands of literature: the first strand from consumer theory, considering specifically the `wealth effect', the second strand from aggregate private savings theory. The original contribution of this paper derives from the main explanatory variables of the household savings function: two measures of household wealth, the first a financial variable and the second a variable for tangible/housing stock. The salience of these variables has not been tested before. The model is then enriched with variables taken from the private savings literature. To find the best technique to estimate the long run savings function, unit root and cointegration tests are carried out, from which evidence of a cointegrating relationship is found. The group means FMOLS is used to estimate the model. The empirical evidence suggests effects consistent with theory: an increase in wealth negatively affects household savings. Furthermore, when important explanatory variables, such as government savings and population dependency ratios, are included in the model, tangible wealth becomes the only kind of wealth to (weakly and negatively) influence household savings in developed countries. In the US however, wealth does not seem to affect household savings negatively, it seems instead that government savings and population changes better explain the decline of savings during the past two decades. This finding provides additional evidence on the issue of global imbalances, and suggests that the recent booms of the stock and the real estate markets should not be blamed for the decline in US household and private savings.

JEL: E21, C23

Keywords: Household Savings, Wealth Effect, Panel Cointegration, Global Imbalances, Life Cycle Model.

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1. Introduction

Since the 1980s the household savings rates in many developed countries have dramatically decreased. The current negative savings rate in the US seems to play a particularly important role in the development of so-called "global imbalances" due to the effect of savings on the US current account deficit. The term "global imbalances" refers to the fundamental imbalance in the global balance of payments, where a widening US current account deficit sees its counterpoint in the surpluses run by a number of countries – mostly East-Asian and oil exporting countries. This scenario has raised some concerns about long-term sustainability and about the possibility of disorderly adjustments. Many observers have called for a coordinated policy response to the problem (for instance, Eichengreen, 2006).[1] According to simple accounting identities, a current account deficit necessarily equals capital inflows to the country. Therefore it equals the negative difference between domestic savings and investments. Hence, global imbalances have often been studied by analyzing saving and investment, both from a global perspective and from a US perspective.[2] Two facts emerge. First, a global savings glut has resulted in funds being channeled to the United States and these funds have financed the United States' large current account deficit. Second, a drop in national saving in the United States is at the root of its current account imbalances.

Regarding the second point, even authors with different ideological perspectives agree that the decline in US private savings is rooted in the increase in households' net worth, which grew as a consequence of the stock market boom up to 2000 and the real estate pricing boom thereafter. For example, Feldstein (2008) and Chandrasekhar and Ghosh (2005) hypothesize that a future increase in US savings would rely on real estate market behavior, where lower prices could lead to an increase in savings rates. Their reasoning is based on the "wealth effect" from standard consumer theory. According to this mechanism, an increase in wealth is followed by an increase in consumption (and a decrease in savings) because changes in wealth directly affect households' contemporaneous budget sets. But, the reasoning that links an increase in prices to a decline in savings ignores a strand of literature on private savings that predominantly disregards wealth when analyzing the determinants of savings. Moreover, the decline in both private and household savings rates began long before the booms that are claimed to have caused them, which casts doubt on the validity of such a univocal explanation.

[1] However, some researchers do not agree on the need for rebalancing actions, feeling that the system is perfectly capable of sustaining such imbalances even in the long run (for instance, Gray, 2004, writes about the possible exhaustion of the international role of the US dollar; Dooley et al., 2005, discuss the Bretton Woods II regime).

[2] From a global perspective, Bernanke (2005), Summers (2004), and Truman (2004); from a US perspective, Roubini and Setser (2004), Faulkner-MacDonagh (2003); sometimes attempts to combine those two perspectives have been made, as in Terrones and Cardarelli (2005).

Declining saving rates critically affect global imbalances. We therefore need to better understand household savings to explain more adequately the role that they play in creating global imbalances. As Eichengreen (2006, 16) asserts, "we know relatively little about how the standard policy variables affect household saving, the component of private saving that has fallen most dramatically in recent years." If action is to be taken, it is important to reach a deeper understanding of what determines savings and consequently to understand how changes in these determinants caused savings to decline. The reasons may lie in financial and housing markets behavior, in fiscal policy, or in demographic changes.

We aim to achieve a better understanding of what drives aggregate household savings, based on a detailed empirical analysis for which we estimate a long run savings function. Using intuitions from the literature on consumer theory, two measures of financial and tangible/housing wealth usually excluded from regression analysis constitute our two main explanatory variables. We collected data for financial wealth from a number of different national sources, while the measure of tangible/housing wealth has been constructed for all the countries in the panel thanks to several kinds of data, building on research by Case et al. (2005). The other explanatory variables are consistent with theory and with the empirical literature on private savings. Most previous studies are based on Modigliani's life-cycle savings hypothesis, which models individual consumption patterns. It seems more plausible, therefore, to test the model using household savings as the dependent variable and to leave aside corporate savings, which is the other component of private savings. Yet corporate savings are probably governed by considerations potentially irrelevant to individual household savings. Furthermore, we check whether explanatory variables conventionally used to study private savings are relevant to household savings. Finally, the methods adopted in this paper provide further support for panel data cointegration techniques to analyze savings on the basis of accurate unit root and cointegration tests.

In line with theory, the main results show that tangible/housing wealth and government savings in developed countries between 1980 and 2005 had significantly negative effects on household savings. Contrary to theory, we find no evidence of a similar negative effect of financial wealth. This is unsurprising since the previous literature usually shows that financial wealth has smaller effects on consumption. Consistent with expectations, the data displays heterogeneity among the countries in the sample. The USA provides the most surprising result – it seems that tangible/housing wealth has a positive effect on household savings, contrary to theory and contrary to the previous evidence on the wealth effect. We hypothesize that this could be the result of two opposing effects of from the two different cohorts of individuals. The first group comprises households who own homes, and for whom increased housing wealth could exert a negative effect

on savings. The second group comprises households intending to buy homes in the future, and for whom rising housing prices could positively affect savings. In fact, “increasing house prices can trigger a variety of responses, in particular from young owners or prospective future homeowners" (Bertola and Hochguertel, 2007, 138). However, this result calls for further research, possibly using household level data.

The rest of the paper is organized as follows. Section 2 provides an overview of the existing literature, as well as a description of the recent developments in savings rates in developed countries. Section 3 discusses the determinants of savings suggested by theory and by empirical evidence, and describes the dataset and the empirical strategy followed in the analysis. Section 4 presents the estimation results. Section 5 concludes briefly.

2. Private and household savings: stylized facts and previous literature

2.1 Stylized facts

Private saving rates have fallen considerably in several high income countries during the last 25 years, as shown in Figure 1. This phenomenon has attracted great attention and several economists have dedicated studies to understand the underlying causes of private savings. For a high number of developed countries, aggregate household savings rates present similar patterns. But, aggregate savings have not been studied as deeply as private savings. Figure 2 shows that in 11 countries out of the 18 OECD sample countries the decline in household savings rates has been a significant phenomenon.

De Serres and Pelgrin (2003) state that the decline in private savings rates in most of the countries coincided with an increase in household financial net worth, but they only provide data for a few countries. They also add (2003, 119) that “even in countries where private saving rates have fallen to particularly low levels, the decline seems to be mostly accounted for by determinants that do not include measures of financial or housing wealth and that have themselves evolved in a sustainable way.”

Our paper puts this statement to the test, presenting new empirical evidence about the importance of wealth on savings when other determinants are taken into account. The benchmark theoretical model for explaining private savings behavior is the life-cycle model originally proposed by Ando and Modigliani (1963) and extended by Jappelli and Pagano (1994). This model shows that people save when young to finance consumption when retired. With no bequests, the dissavings of the old should offset the savings of the young, with the result of no aggregate savings in a stable population. This status quo can change when the age structure of the population is unbalanced or if

the economy experiences high growth that makes the incomes of the young relatively higher than the retirement income of the old. But, this simple model alone could not explain the various and variable private savings rates across the world. Hence, several additional possible determinants have been proposed and most of them have been used in previous econometric models. Household wealth has also been proposed as an explanatory variable, but it has been rarely tested empirically due to problems in finding reliable data. Even if the model explains household savings, the previous literature has always studied aggregate private savings, that include corporate savings. But, corporate savings are probably driven by different considerations than household savings.[3] In this paper, we focus on household savings, providing an important new contribution.

2.2 The empirical literature

The existing empirical literature on aggregate savings makes use of various ways to study the determinants of savings: static or dynamic model specifications, a wide range of explanatory variables, and different estimation techniques. Moreover, while the seminal studies tested static models with a large number of regressors (Edwards, 1995, Loayza et al., 2000), after a path-breaking paper by Haque et al. (1999), dynamic models and heterogeneous panel estimators are now thought to fit the data better and are used in the majority of studies.[4]

Haque et al. (1999) re-examined the existing empirical literature, finding that the regression results neglected heterogeneity and dynamics, which had both influenced the results. By estimating a model with most of the variables already studied in the literature (including those suggested by the life-cycle model), they conclude (1999, 22) that "the fiscal variables (…) are the key determinants of private savings rates in the industrial countries in the post world war II period."

Since then, new techniques have been used to estimate models capable of explaining the behavior of private savings. Most of the scholars exploited the existence of a stable long run relationship among the main variables, either writing the model in an error correction form or using panel cointegration techniques. For example, Ferrucci and Miralles (2007) and De Serres and Pelgrin (2003) use the

[3] The usual justification for the use of private savings instead of household savings is that there is a perfectly negative correlation between household savings and corporate savings. Ferrucci and Miralles (2007, 11) argue as follows, "Although the offset is generally found to be less than one for one, the finding that household saving indeed reacts to corporate saving seems to be sufficiently well documented to allow focusing this study on aggregate private saving." However, we tested the correlation between those two variables at a country level in our panel and, though we found a significant and negative correlation in 13 out of 18 countries, the coefficient was greater than -0.5 in only half of the countries. To concentrate on household savings, instead of limiting the study to private savings, was considered worthwhile.

[4] Another part of the literature concentrates on studying more deeply the effects of single variables, which are claimed to be more important than others. Two notable examples are Heer and Süssmuth (2006), who find no evidence of a negative effect of inflation on savings in the US, claiming that the role of this variable should be revised at a theoretical level. Another is Bloom et al. (2003) who use a modified version of the life cycle model to study the effects of health and longevity.

Pooled Mean Group (PMG) estimator developed by Pesaran et al. (1999); Sarantis and Stewart (2001) estimate a long run model with dynamic OLS (DOLS) for a panel of OECD countries, while Hondroyiannis (2006) analyzes a panel of European countries using the fully modified OLS (FMOLS) estimator. On the other hand, De Mello et al. (2004) and Loayza et al. (2000) use the GMM estimator developed by Arellano and Bond (1991) to better deal with endogeneity problems. However, the GMM estimator allows for a lower degree of heterogeneity with respect to the alternative models proposed above and therefore seems less appealing. Table 1 summarizes the choices made by the authors mentioned.

The authors cited above study aggregate private savings as the dependent variable and use various variables as regressors. However, only in a few cases does theory make unambiguous predictions about these variables' effects on savings. For example, demographic factors are thought to be important because of the impact of population aging: they enter the analysis as dependency ratios, but "higher proportions of the dependents to persons of working age may be associated either with higher or lower saving ratio" (Hondroyiannis, 2006, 556). On the contrary, government savings are always thought to correlate negatively with private savings, due to the effects of Ricardian equivalence (in the case of actual government borrowing, economic agents anticipate that higher taxes will be needed to pay for the borrowing, thus they immediately increase their savings). Government savings is therefore always included in the analysis, and its coefficient typically has a significant and negative impact on private savings. Several other variables are customarily included: productivity growth, changes in terms of trade, the real interest rate, inflation, and liquidity constraints. In most cases, the theoretical predictions about their influences on savings are unclear.

Many of these studies fail to account for household wealth because of problems in finding data. De Serres and Pelgrin (2003) write that relevant data on the stock of wealth are available for only a few countries, while De Mello et al. (2004, 19) state that "household wealth is expected to affect consumption/saving decisions based on permanent income considerations, but data are not readily available for most countries." Since our idea is to test the importance of wealth on savings, a substantial amount of time has been spent searching for this kind of data: we aim, therefore, to fill a gap in the existing empirical literature on aggregate savings.

We comment now on the literature concerning consumption and the wealth effect. The wealth effect has been empirically tested in a number of articles using either household-level or aggregate data.[5]

[5] Consider the following examples. For the USA, Skinner (1996) finds a large and significant effect of housing wealth on consumption using aggregate data, even if in some specifications (for instance, when the long term interest rate is included in the model) the significance disappears. More recently, Belsky and Prakken (2004) find evidence in favor of the housing wealth effect, while Poterba (2000) and Juster et al. (2006) concentrate on the financial wealth effect. Turning to panel studies, Case et al. (2005) study both the financial and the housing wealth effect for a panel of 14 countries, finding a significant effect for the latter only; Edison and Slok (2002) study the financial wealth effect in 7

For the U.S. economy, the wealth effect has been widely analyzed and several studies produced significant estimates of it, ranging between 2 and 7 cents of additional consumption per year per 1 dollar increase in household net wealth. This reflects the magnitude of the effect estimated by the Board of Governors of the Federal Reserve System, which maintains the longest and most regularly updated wealth effect estimates for the USA. In recent studies, different estimates have been produced according to the type of household wealth, dividing house equity and financial wealth (as in Case et al., 2005). Among the studies that use aggregate data, tangible wealth is either not included among the explanatory variables or included as a proxy (such as a house price index) due to problems in finding data for a large number of countries. We overcome this problem by building on an idea by Case et al. (2005), as explained in the next section.

3. Data and empirical strategy

3.1 Model and data

The methods in this paper are closer to the literature on aggregate private savings than to the literature on the wealth effect. To investigate the long run determinants of household savings, we use the following model:

$$Savh_{i,t} = \alpha_{i,0} + \beta_{i,1} Wf_{i,t} + \beta_{i,2} Wt_{i,t} + \beta_{i,j} X_{i,t} + u_{i,t} \qquad (1)$$

where *Savh* is the household savings rate, *Wf* is financial wealth, *Wt* is tangible/housing wealth, and *X* is a vector of explanatory variables taken both from the theory and from the empirical literature on savings (which varies according to the different model specifications). The variables used are described below (detailed sources can be found in the data appendix).

Aggregate household savings are divided by household disposable income to obtain the savings rate, our dependent variable. We consider income to be more appropriate than GDP as the denominator of the ratio, even if most of the literature predominantly uses the latter (a notable exception is Sarantis and Stewart, 2001). Even if countries report data on household savings differently, we feel that it is appropriate to use such a variable for international comparisons, as explained in the Notes to Statistical Annex of the OECD Economic Outlook (the source of these

different countries. See Paiella (2007) for an excellent survey on the evidence of wealth effects, both from aggregate data and from micro data.

data): "since the definition of saving is unaffected by differences in national accounts practices, this is not a source of inconsistency across countries."[6]

Net financial wealth (*Wf*) is also divided by household disposable income. Figure 3 shows the evolution of financial wealth in the countries of the sample and the effects of the 2000 stock market crisis are evident.

Tangible wealth (*Wt*) requires a deeper description. Data on tangible wealth are available only for a few countries,[7] thus the construction of a proxy was necessary to use this variable for panel analysis. We begin with an idea proposed by Case et al. (2005), who built a measure of the housing market wealth for their paper about consumption and the wealth effect.[8] The estimate was constructed according to the following expression:

$$HV = HOr * HhN * PI \qquad (2)$$

where *HV* is the estimated aggregate value of the houses owned by households, *HOr* is the home ownership rate (computed by dividing the number of owner-occupied housing units by the number of occupied housing units or households), *HhN* is the number of households (obtained dividing the population by the household size), *PI* is the residential property price index (annual data produced by the BIS; detailed sources in the data appendix).

Even if equation (2) is similar to that used by Case et al. (2005), our measure is probably more accurate than theirs, since their proxy for *HhN* is the number of persons in the population, while we used the number of households, following more closely the original idea. Moreover, we expressed the measure as an index with 2000 as the base year to have a similar magnitude for every country (after dividing *HV* by the household disposable income). Missing data in the series of home ownership rates and household size were obtained with linear interpolation. A linear interpolation does not pose any particular problems since home ownership rates and household size both follow clear linear trends during the examined period.

[6] To be precise, the differences are the following: household savings include savings of non-profit institutions serving the household sector in all the countries of the sample apart from Finland, France, Japan and New Zealand; most countries report household savings on a net basis (excluding consumption of fixed capital by households), the exceptions being Belgium, Denmark, Portugal, Spain and the United Kingdom.

[7] The best source of data on tangible wealth is the table "Household Wealth and Indebtedness" usually present in the Statistical Annex of the OECD Economic Outlooks. It contains data on tangible wealth for 7 OECD countries since 1980, but for most of the series the data are not harmonized. For some additional countries, data for much shorter periods of time are available from national official sources.

[8] This idea has been exploited by other authors too. For example, Slacalek (2006) uses similar data but claims to be able to construct a measure comparable to the financial wealth one in order to compare the magnitude of the two different wealth effects. However, we believe that in order to do this he makes certain strong assumptions that we prefer to avoid.

According to our measure, during the period of interest household tangible/housing wealth increased in 15 countries out of 18 (see Figure 4), which is consistent with the development of household wealth as described in the majority of national studies and reports. In particular, and as highlighted by Bartiloro et al. (2007), in most countries tangible/housing wealth increased rapidly after the burst of the stock market bubble in 2000. It is important to stress that our proxy for tangible wealth is not directly comparable to the measure of financial wealth, which is expressed as a ratio over disposable income and has an immediate interpretation. Our measure of tangible wealth mostly reflects the movements in housing prices expressed as indexes and does not take into account the size or the quality of the houses, and in this respect is similar to the measure used by Case et al. (2005). We tested the reliability of the proxy by looking at the correlation with the direct measure of tangible wealth for the few countries for which these data are available from the OECD Economic Outlook. The high values reported in the data appendix (Table A1) verify the reliability of our proxy.

To enrich the basic model and to check for the real importance of household wealth in determining savings we used several additional variables: government savings (*savg*, divided by GDP), population dependency ratios (*dr* and *odr*: the former is the standard dependency ratio, while the latter takes into account the elderly part of the population only), liquidity constraints (*lc*, proxied by the ratio between private sector credit and GDP),[9] inflation (*infl*) and the long term interest rate (*r*).

The sample includes the highest number of developed countries for which data were available, and is constituted by 18 OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States of America. The period of analysis is 1980-2005, due to data availability. The panel is slightly unbalanced, because some countries did not have data available for the entire period of interest.

3.2 The empirical strategy

Due to endogeneity and cointegration issues, the estimation of the model described by equation (1) is difficult. Endogeneity arises because wealth, our main explanatory variable, is linked to the accumulation of past savings, our dependent variable. Due to the lack of appropriate instruments this problem is difficult to handle even with household-level data (Bostic et al., 2009). On cointegration, we need to avoid spurious results in the possible presence of cointegrating relationships among non-stationary variables. A number of authors exploited the existence of a

[9] This is the usual proxy in the literature, but we feel that it poses some problems. For example, part of the credit to private sector enters the measure of net financial wealth. We would prefer to use a different, better variable, to measure liquidity constraints, but we are not aware of its existence.

cointegrating relationship by writing the model in an error correction form to handle both the short-run and the long-run dynamics. However, we do not find the error correction form to be essential, since our interest lies in identifying the long run determinants: rebalancing actions should not address variables that influence savings in the short-run only.

Despite these two issues, we begin our analysis with a few different versions of the model of Eq. (1) estimated with the fixed effects estimator (varying the variables included in the vector *X*). Thus we establish a benchmark against which to compare the results obtained with techniques capable of dealing with both endogeneity and cointegration. After the fixed effects estimation, we progress to a deeper analysis by investigating the existence of a cointegrating relationship among the variables of the model. Firstly, panel unit root tests are carried out to understand if the series are stationary, since cointegration can only exist among variables of the same order of integration.[10] Three different tests are carried out: the ones proposed by Levin et al. (2002, LLC) and Hadri (2000), that test for the existence of a common root in the panel, and the one built by Im et al. (2003, IPS), that allows for heterogeneus, individual roots. All tests are carried out in two different model specifications: one assuming an individual intercept and the other with an individual intercept and a time trend.

Secondly, we test for the presence of cointegration among the variables, using both the Pedroni method and the Kao (1999) test. The various tests point to the presence of a cointegrating relationship among our variables of interest, thus the final step of the analysis requires that we use panel cointegration techniques to estimate our model.

Among the estimators widely used in the private savings literature, the GMM by Arellano and Bond (1991), which deals with endogeneity, and the PMG by Pesaran et al. (1999), which handles error correction forms, have been discarded because of the required dimensions of the panel.[11] Two alternatives were then suitable: the DOLS proposed by Kao and Chiang (2000) in the context of panel cointegration, and the 'mean group' FMOLS proposed by Pedroni (2000). Similar to the PMG estimator, both techniques allow for a great amount of heterogeneity, but they have better properties in small samples. Finally, since the DOLS estimator requires far too great a number of leads and lags for the time dimension of our sample, our preferred estimator is the FMOLS.

[10] We choose not to perform tests at single country level, since "it is well known that the traditional unit root tests (…) method involves the low power problem for nonstationary data" (Kim et al. 2005, 75).

[11] However, we performed some estimations with those methods in order to have some benchmark results. The GMM results for a dynamic specification of model (2) are similar to the ones obtained with a fixed effects model, and become closer and closer as we limit the number of instruments. However, even with the minimum number of instruments possible, we cannot satisfy the requirement of having it less than or equal to the number of groups. That is, this estimator is not recommended for a panel with N=18 and T=26. With the PMG estimator we did not obtain clear results, probably for the same reasons.

The group mean panel FMOLS estimator has many useful qualities. Firstly, it has "satisfactory size and power properties even for small panels if T is larger than N" (Maeso-Fernandez et al., 2004, 20). Secondly, it permits a great amount of heterogeneity, even if a common, long-run relationship is estimated in addition to single country coefficients. Thirdly, it allows a flexible alternative hypothesis when estimating the average long-run cointegrating relationship:

$$H_0: \beta_1 = 0 \text{ vs } H_1: \beta_1 \neq 0$$
$$H_0: \beta_2 = 0 \text{ vs } H_1: \beta_2 \neq 0$$

Since neither evidence, nor theory can suggest a possible value of the alternative hypothesis the model's flexibility is seen as advantageous.[12] Lastly, this estimator takes into account the possible correlation between the error term and the differences of the regressors, and therefore makes non-parametric adjustments to the dependent variable before estimating the long run relationship.
The long run coefficient estimators can be written as follows:

$$\hat{\beta}_{FM} = \left(\sum_{t=1}^{T} x_{i,t}^{'} x_{i,t} \right)^{-1} \sum_{t=1}^{T} \left(x_{i,t}^{'} y_{i,t}^{*} - T\hat{\lambda}_i \right) \qquad (3)$$

where y^* are the regressands adjusted for the covariance between the error term and $T\hat{\lambda}$ is the adjustment for the presence of a constant term.
The FMOLS estimator requires that no more than one cointegrating vector among the variables of the model be present, thus we must be careful to choose explanatory variables so that we do not violate this requirement. We use the following procedure. We first estimate the model of equation (1) with the wealth variables only. We then enrich the model with variables taken from the private savings literature, adding them one at a time, to see if they are significant and if they influence the coefficient of the wealth measures. We use those results, the results from the fixed effects estimation, and the conclusions reached in the past savings literature, to estimate a final, more comprehensive model capable of grasping the real importance of wealth in determining savings in the long-run. Additional cointegration tests among the final variables are carried out to ensure that we are using the estimator properly.

[12] See Carroll et al. (2006) for a critical point of view on the reliability of the use of cointegration in the analysis of wealth, consumption/savings and income.

4. Estimation results

Table 2 reports the results of the fixed effects estimation of various specifications of equation (1). Specification 1 is very parsimonious, as the two measures of wealth are the only explanatory variables. The other specifications include more regressors to check if the importance of the two measures of wealth is affected. Specifications 2 and 3 include all the variables of the dataset: the two measures of wealth, the dependency ratio (the standard one in specification 2, the elderly ratio in specification 3), liquidity constraints, inflation and the long term interest rate. Specifications 4 and 5 include only household wealth and the two variables that have proven to be the most important in the previous model specifications: government savings and the two dependency ratios. All the estimations are carried out both without and with time dummies added; this latter specification is indicated with 'td' after the number of the model.

Table 2 shows that the coefficients of the two measures of wealth negatively affect savings, as expected, when they appear as the only explanatory variables of the model. In this case, they account for one third of the variability of household savings. However, when other explanatory variables are added, both financial and tangible/housing wealth maintain significant coefficients only in model 5. Across all the specifications, the wealth coefficients are indeed very low, suggesting an elasticity not higher than .03. This value lies in the lower range of the estimates of the previous literature. On the contrary, the importance of government savings and of the dependency ratios seems to hold across most of the models. Their coefficients are negative and significant at conventional levels in most cases. In all models, the introduction of time dummies leads to lower coefficients for both measures of wealth, but does not affect dramatically the results.

Overall, the fixed effect estimation suggests that wealth negatively affects household savings at panel level, even if its importance diminishes, and sometimes vanishes, when other important determinants of savings are included in the model. But, we do not want to derive strong conclusions from these preliminary fixed effects estimates. Rather, we use these results to guide our analysis using panel cointegration techniques. We start with panel unit root tests.

The results of three different panel unit root tests (LLC, IPS and Hadri) for the series both in levels and in first differences are reported in Table 3. For the LLC and the IPS tests, the choice of the appropriate lag-lenghts are made according to the Schwarz-Bayesan Information Criterion.

Starting from the LLC and the IPS tests, we fail to reject the null hypothesis of nonstationarity at conventional levels for household savings, the two measures of wealth and liquidity constraints. In the case of the two dependency ratios the evidence is mixed, while the null is rejected for the other variables: inflation, long term interest rate and government savings (even if the LLC does not yield clear results). The Hadri test seems to over-reject the null hypothesis of stationarity. However, due

to the results of the other tests, it can be concluded that household savings, the two measures of wealth and liquidity constraints appear to be integrated of order 1 in our dataset. The other variables seem to be stationary, even if particular attention is required to read the results for the two dependency ratios. The first dependency ratio (*odr*) appears to be stationary only when a time trend is not included in the specification, while for the other dependency ratio results change dramatically depending on the test.

Among the variables that appear to be integrated of the same order, it is necessary to look for a cointegrating relationship. Firstly, we check for the existence of cointegration among the dependent variable and the two measures of wealth that are our main subject of interest and are included in every model version that we estimate. Secondly, since we need to be sure that there is only one cointegrating relationship, we also check for the existence of cointegration among the explanatory variables: if present, we cannot apply the FMOLS estimator to estimate the model described by equation (1). Results of both the Pedroni and the Kao tests are reported in Table 4 for two different specifications: with an intercept only and with an intercept and trend. Considering the Pedroni statistics in table 4, we chose to report only the two most meaningful ones according to the characteristics of our panel, that is, the non-parametric (PP) and the parametric (ADF) t-statistics. We exclude other statistics for the following reasons. Firstly, the v and the rho statistics are more reliable when the time dimension is at least equal to 100, which is not the case.[13] Secondly, the within-dimension weighted statistics are excluded in favor of the unweighted statistics because the unweighted statistics perform better in small samples. Thirdly, we chose to report the Kao test, even though it does not allow for heterogeneity between groups. The results from the Kao test are inconsistent with the results from the Pedroni tests, but we believe that we can ignore the Kao test results because, as mentioned, they neglect heterogeneity. Finally, we concentrate on the results of the specifications with the intercept only, since the trend is excluded in the model that we estimate.

The tests seem to point towards the existence of cointegration among household savings and the two measures of wealth (the null hypothesis of no cointegration is rejected in 3 cases out of 4). On the contrary, it seems that there are no cointegrating relationships among the explanatory variables. The null hypothesis is never rejected for the case of the two measures of wealth, and it is rejected in only 1 case out of 4 when liquidity constraints and the two dependency ratios are added to the measures of wealth. This confirms that there is only one cointegrating relationship among the variables of the model when the explanatory variables are just financial wealth and tangible/housing

[13] "Overall, Pedroni (1997) suggests that the panel-rho statistic seems to be the most reliable when T is large enough; for small T, the parametric group-t statistic and the panel-t statistic appear to have the highest power, followed by the panel-rho statistic" (Maeso-Fernandez et al., 2004, p. 17). Moreover, "Pedroni (1997) reports Monte Carlo simulations indicating that the panel rho and group rho have power ranging from 0 to 20% for samples with T=20, N-20. He finds that the variance-ratio tests consistently produced low power and large size distortions" (Bonham et al., 2004, p. 16).

wealth, and also when other regressors are added one at a time, as is the case in certain models considered in the next sub-section.

4.1 The FMOLS estimation

As a preliminary step before estimating the final specification, we estimated seven different versions of the model described by equation (1). In this first stage of the analysis, we use only three regressors. The results of these estimations will be useful to construct the final and more comprehensive model. Only the coefficients for the whole panel are reported, even if we obtained different coefficients for each country in the sample. The right section of Table 5 shows the results for the models when time dummies are added.

The coefficients of the household wealth variables are negative and highly significant in most specifications. Concentrating on the models including time dummies, we can draw the following preliminary conclusions. In all but one case, the coefficients of the two measures of wealth are negative, as suggested by consumer theory. But, in only a few cases are the coefficients of financial wealth significant. On the contrary, tangible/housing wealth has significant and negative coefficients in every specification of the model. Also, the values of the coefficients are generally higher than the ones found with the fixed effects estimation.

Some considerations about the additional explanatory variables are also worthwhile, with one premise: for most variables, the ambiguity from a theoretical point of view is usually confirmed by mixed empirical results in the literature. To make an example, inflation is found to have a negative coefficient by Haque et al. (1999), while Hondroyiannis (2006) estimates a positive relationship with savings. Table 5 shows that the inclusion of time dummies leads to a change of sign for all the additional explanatory variables apart from liquidity constraints (whose coefficient becomes insignificant when time dummies are included). The non-significance of the coefficients of government savings, is particularly striking, since it contradicts both the results of the fixed effects estimation and the ones of the previous literature. Another difference with our preliminary estimation lies in the coefficient of the long term interest rate, which turns out to be significant. What is confirmed here is the low importance of inflation and liquidity constraints, as well as the importance of the dependency ratios.

On the basis of these results, and assessing findings from the literature on private savings, we select the variables that should be included in a correctly specified long run savings function. In addition to the two measures of wealth, we include government savings (based on the findings of the fixed effects estimation, as well as of the savings literature) and the dependency ratio. We exclude inflation, liquidity constraints (because of the predominant non-significant results found in the

preliminary estimations), and the long term interest rate (since it has rarely been significant in the previous literature and our fixed effects estimation does not suggest a primary role for it).

Firstly, we must ensure that there is no cointegration among the regressors. Consequently, in Table 6 we report the results of Pedroni's PP and ADF t-statistics. As it is often the case with such tests, the results are unclear. When the intercept alone is included in the specification, the within-dimension statistics fail to reject the null hypothesis of no cointegration. The opposite occurs with the between-dimension statistics. Thus, we proceed to estimate the final model, concentrating on several robustness checks to be sure that our conclusions are not undermined by errors in the econometric method that we chose to apply.

For the final estimation, we present the coefficients for each country in the sample together with the coefficients for the whole panel. Table 7 shows the results of the estimation with one dependency ratio only (when the other dependency ratio is used the results are qualitatively similar). Time dummies and country-specific intercepts are included.

At first glance, Table 7 confirms the existence of a negative relationship between household savings and tangible/housing wealth, since the panel coefficient is negative and highly significant. The elasticity is -0.04, which is within the range of estimates of the previous empirical literature. A negative relationship with savings is also found for government savings and for the dependency ratio. The coefficient of financial wealth is positive, though its value is close to zero. The results seem to confirm the findings of the fixed effects estimation only partially, since in most of the specifications with fixed effects, the coefficients on both measures of wealth were not significant once other variables were included in the model. The high degree of heterogeneity across countries could play a crucial role in explaining this difference. Even though the panel coefficient of the dependency ratio is negative and significant, only 6 countries out of 18 present a similar result, suggesting that excluding one of them could lead to a change in the panel coefficient. The results for the USA are pertinent: the coefficients of the measures of wealth are both positive (even if the coefficient of tangible/housing wealth alone is significant at standard levels). This is a surprising result, since, if it is indeed robust, it would contradict substantial empirical evidence of a positive effect of increases in wealth on consumption, and thus a negative effect on savings.

To confirm whether the results are reliable we perform several robustness checks. Probably the most important check is to re-estimate the model excluding one country at a time. In such a small sample, results could change dramatically with a slight modification such as decreasing the number of countries. Consider the panel level results. In the 18 new estimates, the coefficients of the four variables do not maintain either the same sign, or the same significance, or both jointly. Such a weakness is found both for financial wealth (since the coefficient varies greatly across the 18 new

estimates) and for the dependency ratio (since the coefficient changes from negative to positive in half of the new estimates). Also, the coefficient of tangible/housing wealth is positive in 3 cases, while government savings is positive only when Germany is excluded from the sample. However, half of the countries in the sample maintain significant and negative coefficients for tangible/housing wealth and government savings variables in all the new estimates, which we may read as a proof of the importance they exert on household savings. Moreover, the surprising results of the US case hold across all specifications, suggesting that the negative relationships for tangible/housing wealth and government savings does not hold for the US economy.

Another robustness check is the re-estimation of the model with the elderly dependency ratio in place of the other one. Though small differences appear, we reach similar conclusions. The results for tangible/housing wealth appear to hold more strongly than before and the US case presents the same surprising results. This finding appears to be the most robust. For the entire panel of developed countries, we may also speak of weak evidence favoring the existence of negative effects on household savings from tangible/housing wealth and from government savings.

We performed two additional robustness checks. In the first check, two alternative dependent variables were used to re-estimate the final model: the ratio between household savings and GDP, for which the results do not change substantially, and the ratio between private savings and GDP. With the latter, the result strengthens the coefficients of government savings, which become negative and significant for most countries, as well as at the panel level, in line with the previous literature. At the same time, and as expected, both measures of wealth lose their importance, while mixed evidence is presented for the dependency ratios.

As a last robustness check, all the models were re-estimated with a different proxy for tangible/housing wealth, with the number of households replaced by the population (following Case et al., 2005, more closely). The results do not change substantially.

5. Conclusions

In order to study aggregate household savings this paper merges two strands of literature. Because it establishes a long-run relationship between savings and several explanatory variables, the model is embedded in a larger literature relating to aggregate private savings. Since the main idea was to test the relevance of the literature on consumption and the wealth effect, the main regressors were two measures of household wealth (financial wealth and tangible/housing wealth). A great effort was devoted to collecting net financial wealth data and the data that were used to build the proxy for tangible wealth. To test their importance in a comprehensive model, the preferred specification

contained a variable for government savings, which has often explained private savings in the previous literature, and a dependency ratio.

Using an econometric framework that allows great heterogeneity, this paper finds evidence that tangible/housing wealth in developed countries negatively affected household savings in the period 1980-2005. The estimated elasticity (-0.04) is consistent with the literature on the wealth effect. This is true even when government savings and other variables from the literature on private savings enter the model. A similar effect for financial wealth does not seem evident. The results provide partial support for the authors currently blaming the housing market boom for the decline in household savings ratios. However, since the decline is a longer period phenomenon, it only constitutes a part of the underlying story. For the period under consideration, household tangible/housing wealth increased for most of the countries in the sample for many reasons additional to the behavior of prices. For instance, the developments of home ownership rates should be taken into account when speaking about household wealth. Lastly, the US results with the final model show a positive coefficient for tangible/housing wealth, providing evidence against the existence of an aggregate wealth effect in the US. This is particularly striking, since for the US there is substantial empirical evidence supporting a significant negative wealth effect on savings. In our model we control for the possible effects of national peculiarities, since we included country-specific dummies in the final specification. The lack of a universal health care system in the US is therefore appropriately taken into account and should not be thought of driving our results.

Our analysis suggests that when other explanatory variables enter the analysis, the negative effects of wealth increases on household savings disappear. This is in line with other studies that present doubts about the channels by which the wealth effect operates (Poterba, 2000, and McCarthy and Steindel, 2006). Consider the following explanation. While rising property prices may exert a negative influence on savings for home owners, they could exert the opposite effect on households planning to buy houses because they would be forced to save more to buy more expensive houses. Both effects can be captured by our tangible/housing wealth variable, since it reflects movements of property prices, as explained in Section 3. Our analysis suggests that the positive wealth effect of households intending to buy offsets the negative effect enjoyed by home owners. This suggests that policy authorities that are willing to act to increase savings should not wait for housing prices to decrease to see an increase in household and private savings. Instead, they should take actions to correct savings independently of the movements of housing prices. Consequently, the causes of the decline in aggregate household savings must relate to something else. For example, Blanchard (2007) suggests that, in addition to public dissaving, incorrect expectations about retirement

benefits and health care could be at the root of the US household behavior. Both are variables that can be influenced by the fiscal authorities, for example via information campaigns.

To conclude, since the importance of other variables related to the life-cycle model could be tested, additional work is definitely required. Finally, it would be interesting to perform a detailed analysis of household savings for the US case, still using variables both from the wealth effect theory and from the private savings literature. Expanding the analysis using data at the household or individual level seems to be the natural extension of the present work to study additional features that cannot be grasped with aggregate data. For example, age-related considerations and the effects that the distribution of wealth among households could present are better analyzed with micro data and several authors suggest that it could play an important role in determining the wealth effect.

Data Appendix

Household savings (Savh). The variable is constructed by dividing SAVH (household saving) by GDP (gross domestic product). The source for both series is the OECD Economic Outlook No. 81, June 2007.

Household financial wealth (Wf). The variable is constructed by dividing the Net financial wealth (assets – liabilities) by household disposable income (YDH, taken from the OECD Economic Outlook No. 81, June 2007). The sources for financial assets and liabilities are the following: Australia: "Australian National Accounts: Financial Accounts" (5232.0), Australian Bureau of Statistics, Canberra. Austria: OeNB. Belgium: Nationale Bank van België (many thanks to Ms Viviane de Pré). Canada: Riccardo de Bonis, Daniele Fano and Teresa Sbano provided me the data for this and 7 other countries (from now onwards I will refer to this source as dBFS). The data on assets are described in de Bonis, Fano and Sbano (2007). I am really grateful to them for this great help. Denmark: Eurostat Financial Accounts. Finland: Eurostat Financial Accounts. France: dBFS. Germany: dBFS. Italy: dBFS. Japan: dBFS. Netherlands: Eurostat Financial Accounts. Norway: Statistisk Sentralbyrå (many thanks to Mr Torbjørn Rønning). Portugal: estimates produced by Cardoso and Geraldes da Cuhna (2005). Spain: dBFS. Sweden: Statistiska Centralbyrån (many thanks to Mr Michael Wolf and Ms Maria Andersson). Switzerland: Schweizerische Nationalbank. United Kingdom: dBFS. United States of America: dBFS.

Household tangible/housing wealth (Wt). The variable is constructed as described in Section 3. The index has been built thanks to 3 separate variables, each one of them was taken from a number of different sources (the exception being Portugal, since we used the estimation by Cardoso and Geraldes da Cuhna (2005), since data on house prices have proven difficult to be found).

Home ownership rates have been collected from several different national sources. As we realized during the data collection period, there does not exist a unique source for this kind of data for groups of countries. Data on recent years have been published by the United Nations in the “UN Bulletin of Housing Statistics for Europe and North America” (2006). One of the few attempts to merge information to build a rich dataset is Atterhög (2005). This article proved useful especially for the list of national sources for 13 developed countries, even if the data that we collected sometimes differ from the ones reported there. The additional sources that we used are the following: Australia: Australian Bureau of Statistics. Austria: Statistics Austria (many thanks to Ms Johanna Janecek). Belgium: Belgian Census and Population Registers. Canada: Source: Canada Mortgage and Housing Corporation, adapted from Statistics Canada (Census of Canada). Denmark: Statistics Denmark. Finland: Tilastoteskus (many thanks to Mr Petri Kettunen). France: Institut

National de la Statistique et des Études Économiques. Germany: Atterhög (2005) and United Nations. Italy: Istat (many thanks to Mr Armando Dionisi). Japan: Japan Bureau of Statistics (many thanks to Mr Masao Matsumoto). Netherlands: Atterhog (2005). Norway: Statistisk Sentralbyrå. Spain: Atterhög (2005) and Household Continuous Budget Survey. Sweden: Statistiska Centralbyrån (many thanks to Ms Karin Rosén Karlsson). Switzerland: Swiss Federal Statistical Office. United Kingdom: Statistics U.K. United States of America: U.S. Census Bureau.

Figure A1 illustrates the data that we collected. As far as we know, this dataset is one of the few existing comprehensive datasets on home ownership rates.

The number of households for each country has been calculated by dividing the population (source: World Development Indicators, World Bank) by the household size. For the latter type of data, the article "Indicator Fact Sheet Signals" published by the European Environment Agency (EEA (2001)) has proven useful. Data about the number of households there "are generally based on data collection by national surveys". Data about the latest year of the period of interest have been collected from various other national sources (in some cases data for the whole period have been taken from one of the following national sources): Australia: Australian Government, Department of Family and Community Services. Austria: Statistics Austria. Belgium: 1991, Recensement de la population et des logements de la Direction générale Statistique et Information économique (situation au 1 mars); à partir de 1998, Registre national (situation au 1 janvier) - calculs Direction générale Statistique et Information économique. Canada: Canada's Office of Consumer Affairs (OCA), Consumer Report. Denmark: Statistics Denmark. Finland: Tilastoteskus. France: recensements 1975 à 1990, estimations à partir du recensement 1999, de Sitadel et de l'enquête annuelle de recensement 2005, INSEE et SESP. Germany: Statistiches Bundesamt Deutschland. Italy: Istat. Japan: Japan Bureau of Statistics. Netherlands: Statistics Netherlands. Norway: Statistisk Sentralbyrå. Spain: Census (1991 and 2001), Aceprensa (1981), Spanish Propery News (2006). Sweden: Statistiska Centralbyrån. Switzerland: Census and Global Dem.com. United Kingdom: Communities and Local Government. United States of America: U.S. Census Bureau, Current Population Survey. Figure A2 illustrates the data that we collected. We believe that they show an interesting (although well known) trend for developed countries.

The house price index for all the countries in the sample comes from the Bank for International Settlements (many thanks to Mr Markus Kramer). Here is the detailed source: Residential property prices.csv: "National sources" as per detailed documentation; Residential property prices IT.xls Nomisma; http://www.reinet.or.jp/e/jreidata/a_shi/index.htm: source for Japanese residential property prices; Annual residential property prices.xls: "BIS calculations based on national data".

We believe that our measure of tangible/housing wealth is very accurate. Tangible wealth data are available only for some countries in the OECD Economic Outlook, and the following table presents the correlation between the OECD data and our measure. Data for Sweden were kindly provided by Mr Michael Wolf, of Statistics Sweden. The correlation is very close to 1 and it is always statistically significant for all countries apart from Germany.

Government savings (Savg). The variable is constructed by dividing SAVG (government saving) by GDP (gross domestic product). The source for both series is the OECD Economic Outlook No. 81, June 2007.

Dependency ratio (dr). The dependency ratio is the ratio of dependents (people younger than 15 and older than 64) to the working-age population (those ages 15-64). The source is the World Bank, World Development Indicators.

Elderly dependency ratio (odr). The difference with the previous dependency ratio lies in the numerator, because only the fraction of population older than 64 is divided by the working age population.

Inflation (infl). Inflation has been calculated as the yearly variation of the Consumer Price Index, taken from the OECD Economic Outlook No. 81, June 2007.

Long term interest rate (r). This is the long-term interest rate on government bonds, taken from the OECD Economic Outlook No. 81, June 2007.

Liquidity constraints (lc). This variable is constructed as the ratio between credit to private sector (source: International Monetary Fund, International Financial Statistics) and GDP (taken again from the OECD Economic Outlook No. 81, June 2007).

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Figures and Tables

Figure 1. Declining private saving rates in some developed countries

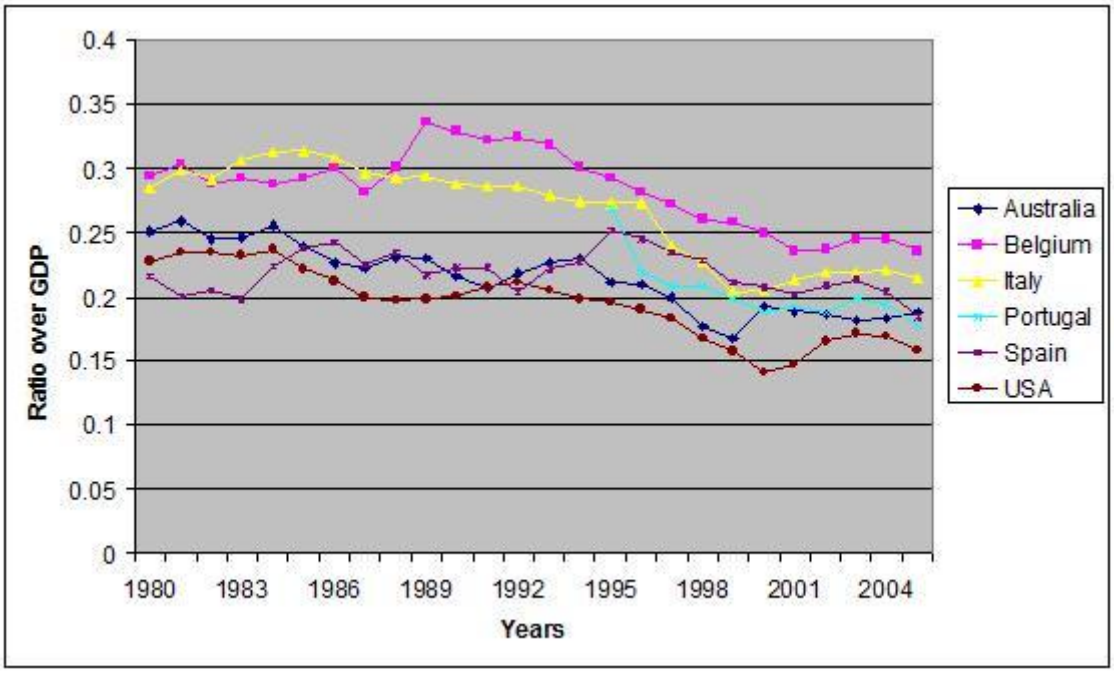

Figure 2. Declining household saving rates in developed countries

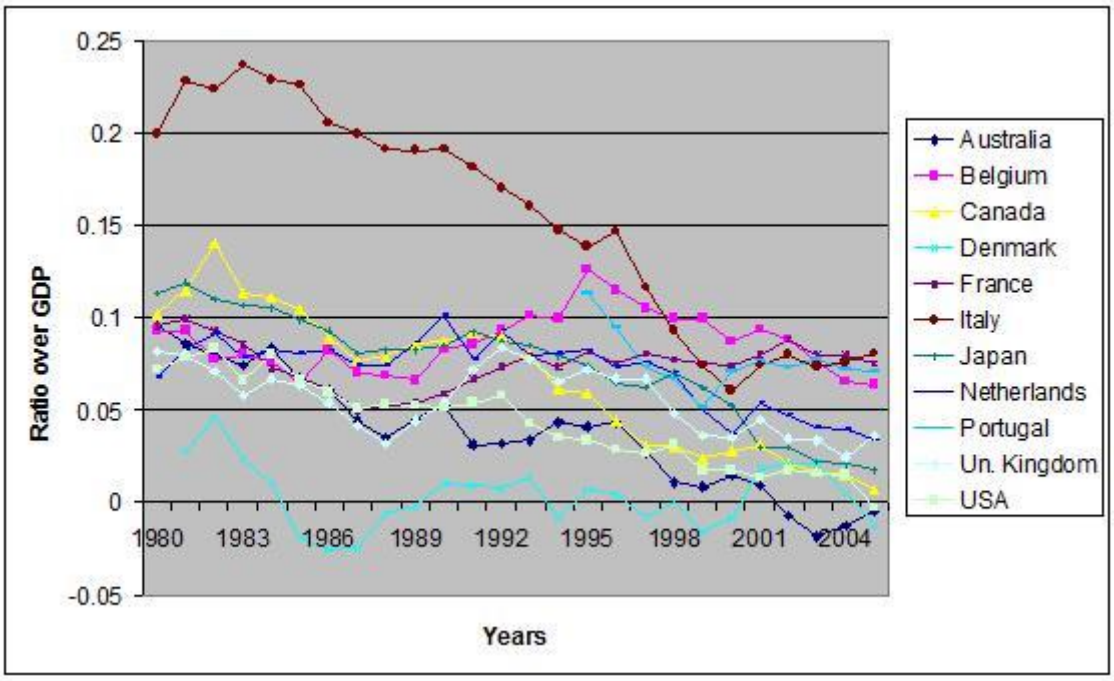

Figure 3. Financial wealth in developed countries

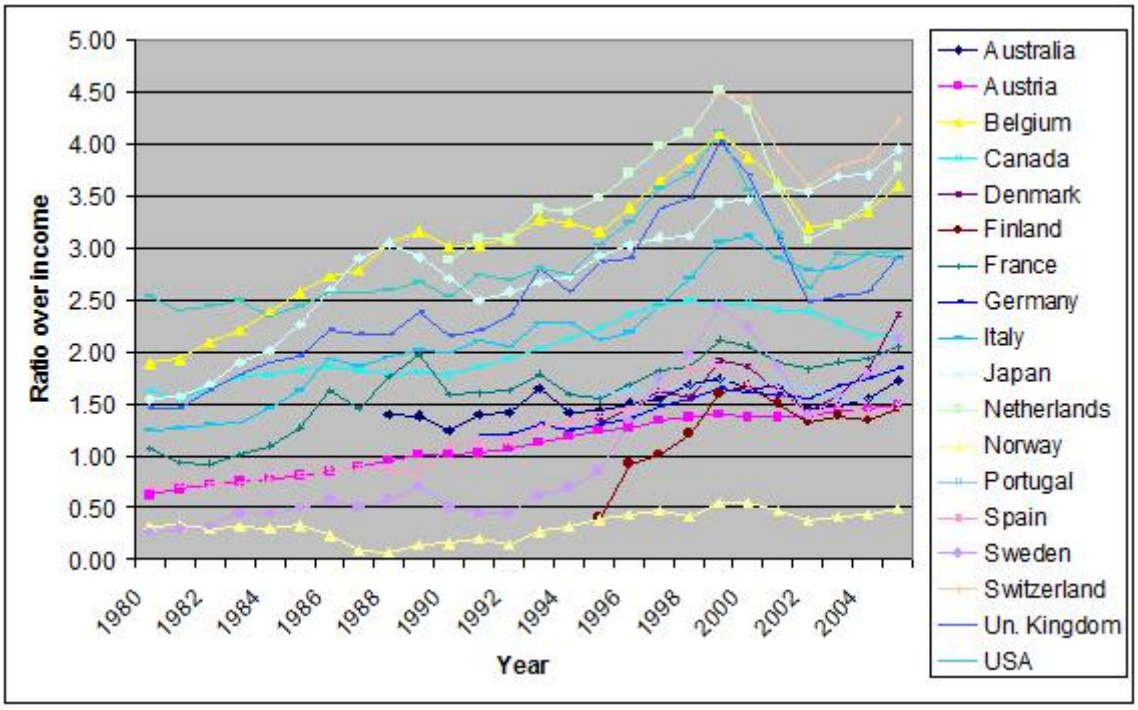

Figure 4. Tangible/housing wealth in developed countries

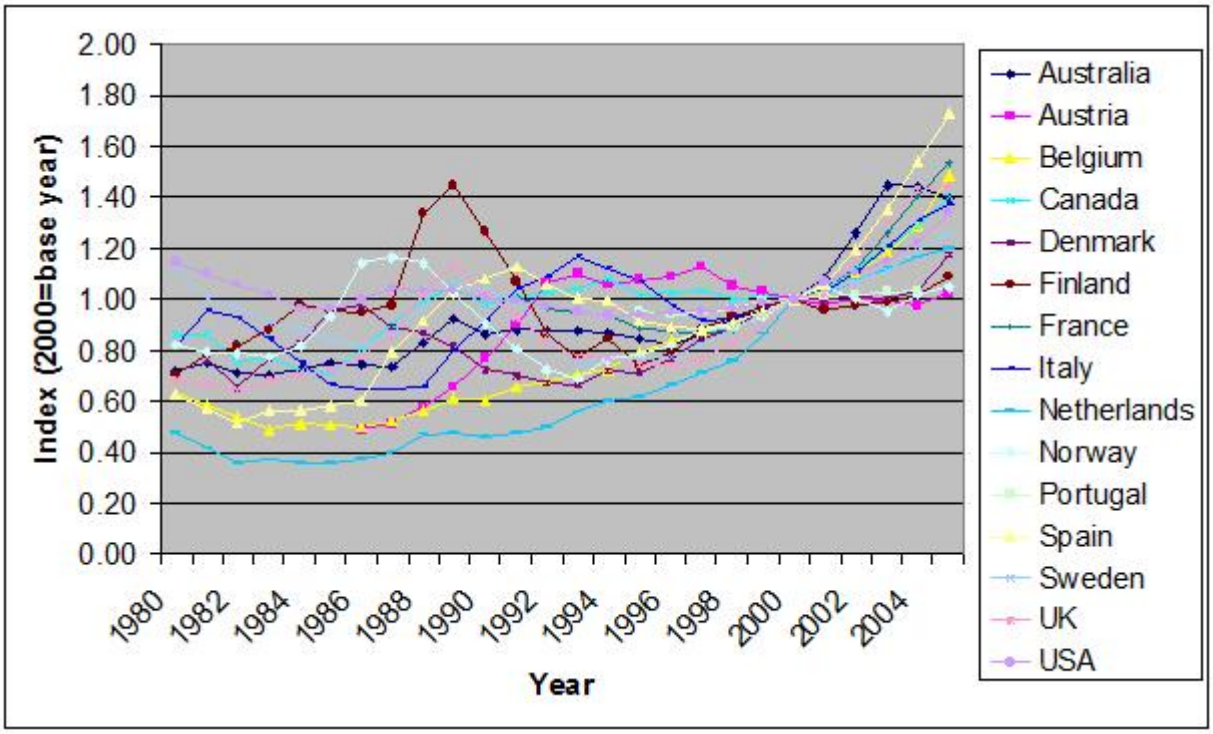

Figure A1. Home ownership rates in developed countries

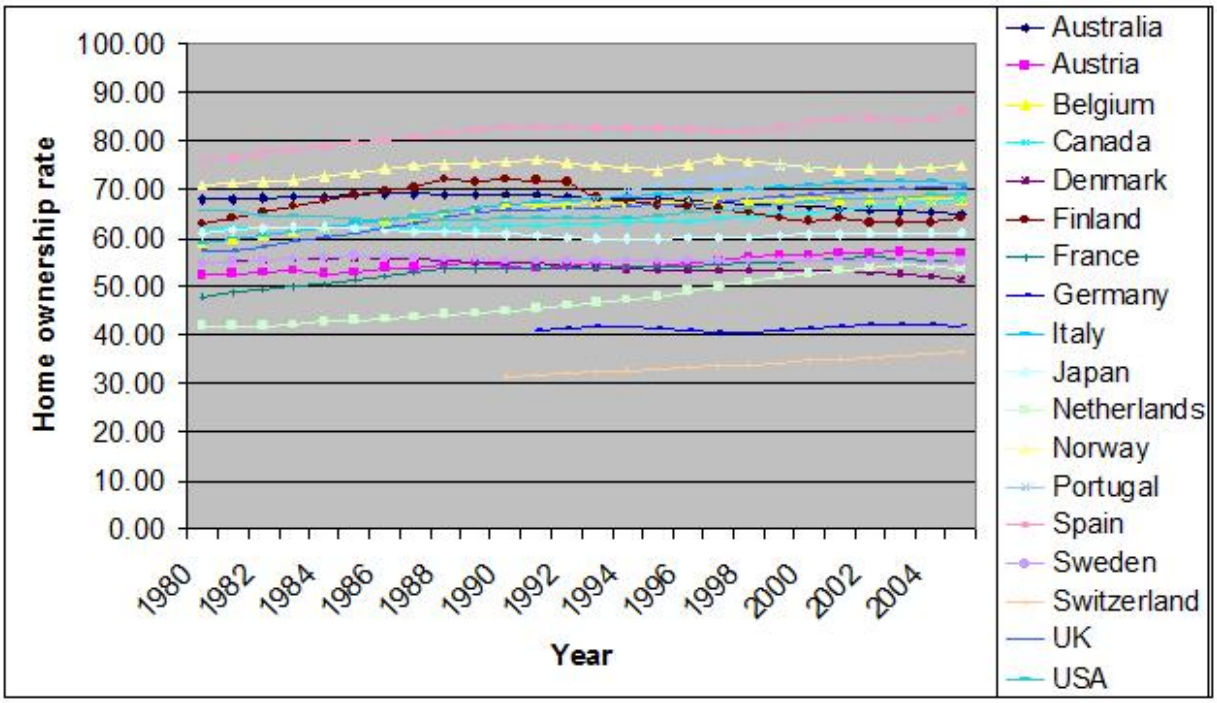

Figure A2. Household sizes in developed countries

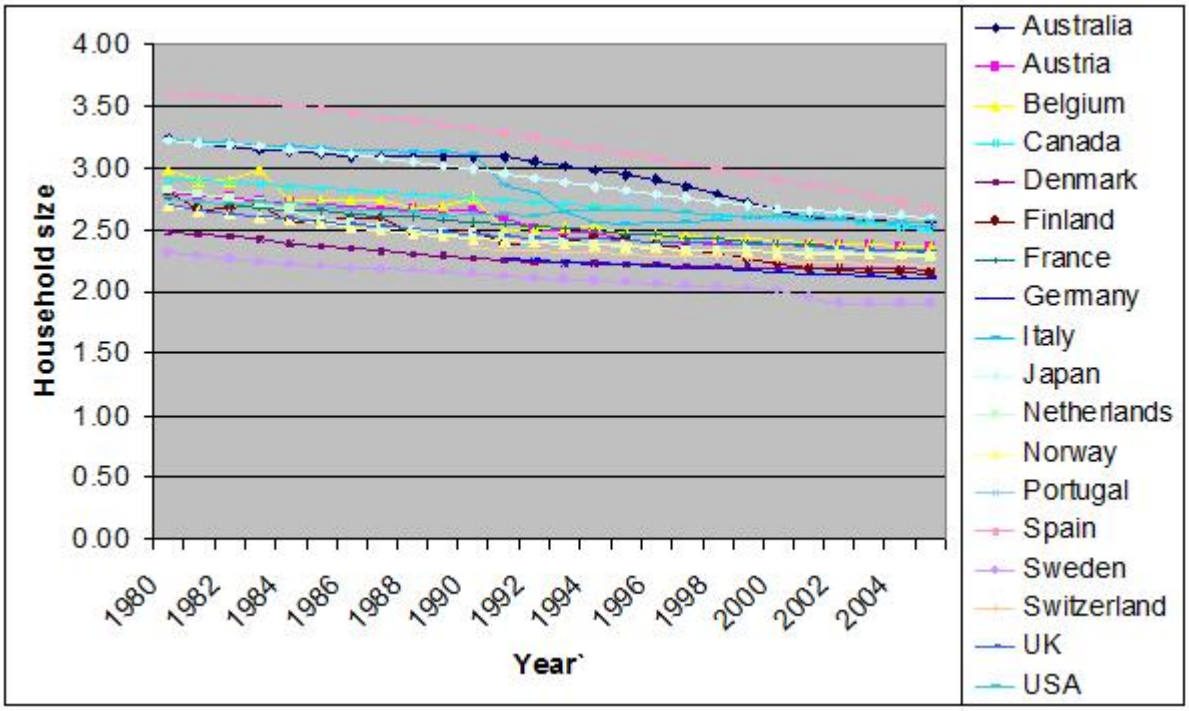

Table 1. Existing literature: examined panels and econometric choices

Article	N. of countries	N. of years	Estimation technique
Edwards 1995	36	23	IV
Loayza et al. 2000	69	variable	GMM
Bloom et al. 2003	68	20	FE
Haque et al. 1999	21	23	PMG
De Mello et al. 2004	21	33	GMM
De Serres et al. 2003	15	31	PMG
Ferrucci et al. 2007	48	26	PMG
Sarantis et al. 2001	20	40	DOLS
Hondroyiannis 2006	13	38	FMOLS

Table 2. Fixed Effects estimation results, 5 different models

	1	1td	2	2td	3	3td	4	4td	5	5td
Wf	-0.02***	-0.01**	0.00	0.00	0.01	0.00	0.00	0.00	-0.02***	-0.01*
	(-7.84)	(-2.30)	(-0.84)	(-0.89)	-1.63	-0.95	(-0.12)	-0.20	(-7.29)	(-1.79)
Wt	-0.03***	-0.02*	-0.01*	-0.01	0.00	0.00	0.00	-0.01	-0.03***	-0.02*
	(-4.54)	(-1.89)	(-1.66)	(-1.40)	(0.60)	(-0.15)	(-0.27)	(-0.81)	(-3.63)	(-1.77)
savg			-0.17***	-0.12**	-0.32***	-0.27***	-0.27***	-0.23***	-0.11**	-0.08
			(-3.54)	(-2.05)	(-6.77)	(-5.09)	(-5.92)	(-4.56)	(-2.30)	(-1.40)
dr			-0.20***	-0.24***					-0.11*	-0.20***
			(-2.83)	(-3.15)					(-1.65)	(-2.80)
odr					-0.67***	-0.77***	-0.69***	-0.75***		
					(-9.41)	(-10.03)	(-10.17)	(-10.26)		
lc			0.00	0.00	-0.01	-0.01*				
			(-0.19)	-0.43	(-1.16)	(-1.92)				
infl			0.00	0.00	0.00**	0.00*				
			(1.54)	(0.39)	(2.35)	(1.76)				
r			0.00***	0.00**	0.00	0.00				
			(2.66)	(2.02)	(-0.27)	(0.43)				
R^2	0.26	0.33	0.33	0.38	0.46	0.51	0.44	0.50	0.27	0.35
No. of obs.	368	368	365	365	365	365	368	368	368	368

t-values are in parenthesis; *, **, *** significant at 10, 5 and 1% respectively.

Table 3. Panel unit root tests results, p-values

Variables	LLC		IPS		Hadri~	
	Individual intercept	Ind. interc. and trend	Individual intercept	Ind. interc. and trend	Individual intercept	Ind. interc. and trend
Savh	0.54	0.19	0.55	0.01	0.00	0.00
D(savh)	0.00	0.00	0.00	0.00	0.84	0.08
Wf	0.01	0.21	0.37	0.16	0.00	0.00
D(wf)	0.00	0.00	0.00	0.00	0.48	0.00
Wt	1.00	0.89	1.00	0.69	0.00	0.00
D(wt)	0.01	0.01	0.00	0.00	0.00	0.00
Savg	0.13	0.08	0.03	0.01	0.00	0.00
D(savg)	0.00	0.00	0.00	0.00	0.73	0.14
odr	0.52	0.00	0.96	0.00	0.00	0.00
D(odr)	0.01	1.00	0.00	0.44	0.00	0.00
dr	0.59	1.00	0.00	0.00	0.00	0.00
D(dr)	0.00	0.02	0.00	0.00	0.00	0.00
infl	0.00	0.00	0.00	0.00	0.00	0.00
D(infl)	0.00	0.00	0.00	0.00	0.00	0.00
r	0.01	0.00	0.90	0.00	0.00	0.00
D(r)	0.00	0.00	0.00	0.00	0.52	0.00
lc	1.00	0.41	1.00	0.77	0.00	0.00
D(lc)	0.00	0.00	0.00	0.00	0.00	0.00

~ Null hypothesis here is No Unit root, differently from the other tests.The p-values of the tests are reported in the table for both the series and their first differences; the test statistics follow an asymptotic normal distribution (correcting for the dimensions of the panel does not affect the results).

Table 4. Panel cointegration tests

		Within dimension		Between dimension	
	Model Specification	Intercept, no trend	Intercept and trend	Intercept, no trend	Intercept and trend
Variables	Statistics				
Savh, Wf	PP	-0.401	-1.980**	0.85	-3.531***
	ADF	-1.255	-3.060***	-0.001	-3.916***
	Kao (ADF)	0.568			
Savh, Wt	PP	-0.946	-1.561	-0.321	-1.493
	ADF	-2.118**	-2.146**	-1.294	-3.009***
	Kao (ADF)	-1.068			
Savh, Wf, Wt	PP	-1.02	-1.071	-2.892***	-4.572***
	ADF	-2.411**	-1.064	-3.852***	-3.697***
	Kao (ADF)	0.521			
Wt, Wf	PP	-0.123	-0.047	1.058	0.683
	ADF	-0.539	-3.592***	-0.982	-3.717***
	Kao (ADF)	-2.753***			
Wf, Wt, lc	PP	0.561	0.806	-1.102	-1.418
	ADF	-0.973	-2.317**	-3.513***	-5.042***
	Kao (ADF)	-3.226***			
Wf, Wt, Odr	PP	0.826	0.047	0.372	-2.546**
	ADF	-0.387	-5.653***	-2.147**	-7.941***
	Kao (ADF)	-3.577***			
Wf, Wt, dr	PP	1.161	0.273	0.463	-3.626***
	ADF	0.616	-5.428***	-1.933*	-8.086***
	Kao (ADF)	-2.688***			

Null hypothesis for all tests is No cointegration. The choice of the appropriate lag-lenghts for both the PP and the ADF statistics are made according to the Schwarz-Bayesan Information Criterion.

*, **, *** significant at 10, 5 and 1% respectively. The tests are one-sided and the statistics are normally distributed.

Table 5. Long run household savings function: FMOLS cointegration estimates, 7 different models

Models	Model with no time dummies			Model with time dummies		
1	Wf	Wt		Wf	Wt	
	-0.03***	-0.04***		-0.01	-0.08***	
	(-12.74)	(-10.96)		(0.57)	(-8.28)	
2	Wf	Wt	savg	Wf	Wt	savg
	-0.01***	0.01	-0.19	-0.06	-0.08***	0.67
	(-17.28)	(1.21)	(0.58)	(-0.06)	(-9.61)	(-1.04)
3	Wf	Wt	dr	Wf	Wt	dr
	-0.00***	-0.16***	-7.58***	-0.01***	-0.06***	0.90***
	(-20.61)	(-17.77)	(-5.87)	(7.64)	(-2.51)	(6.06)
4	Wf	Wt	odr	Wf	Wt	odr
	-0.06***	0.06***	-0.11***	-0.00	-0.05***	6.22***
	(-18.27)	(-2.71)	(4.81)	(-0.47)	(-8.52)	(-2.54)
5	Wf	Wt	infl	Wf	Wt	infl
	-0.04***	-0.04***	0.01***	0.00***	-0.11***	-0.00
	(-20.89)	(-9.32)	(13.39)	(-3.34)	(-15.70)	(0.31)
6	Wf	Wt	r	Wf	Wt	r
	-0.06***	0.26***	0.02***	-0.01	-0.12***	-0.07***
	(-16.33)	(16.33)	(24.94)	(-0.69)	(-13.33)	(-3.61)
7	Wf	Wt	lc	Wf	Wt	lc
	-0.05***	-0.25***	-0.11***	-0.03***	-0.14***	-0.00
	(4.79)	(8.12)	(-18.37)	(-4.34)	(-7.15)	(-0.54)

t-values are in parenthesis; *, **, *** significant at 10, 5 and 1% respectively.

Table 6. Panel cointegration test results, wealth measures and additional explanatory variables

		Within dimension		Between dimension	
	Model Specification	Intercept, no trend	Intercept and trend	Intercept, no trend	Intercept and trend
Variables	Statistics				
Wf, Wt, savg, odr	PP	0.607	-1.360	-3.494***	-3.434***
	ADF	0.640	-4.513***	-4.307***	-5.496***
Wf, Wt, savg, dr	PP	2.735	-0.219	-2.887***	-5.288***
	ADF	1.554	-2.307**	-3.544***	-6.063***

Null hypothesis for all tests is No cointegration. *, **, *** significant at 10, 5 and 1% respectively.

The tests are one-sided and the statistics are normally distributed.

Table 7. Long run household savings function: FMOLS cointegration estimates, the final model

	Wf	Wt	savg	dr
Australia	0.01	-0.18***	-0.19	-0.40
	(0.70)	(-3.82)	(-0.40)	(-0.71)
Austria	-0.03**	-0.04***	-0.03	0.54
	(-2.20)	(-3.35)	(-0.18)	(1.13)
Belgium	0.05**	-0.01	0.60**	0.07
	(2.31)	(-0.26)	(1.98)	(0.12)
Canada	0.02	-0.05	-1.64***	-1.37***
	(0.89)	(-0.52)	(-6.71)	(-3.15)
Denmark	0.33***	-0.20***	-8.34***	6.03***
	(11.05)	(-6.60)	(-15.51)	(-21.26)
Finland	-0.17**	0.08	1.50***	2.74
	(-2.54)	(1.07)	(3.22)	(0.70)
France	-0.05***	0.04	-0.92***	0.51
	(-2.85)	(1.37)	(-3.92)	(1.25)
Germany	-0.02***	-0.08***	0.19***	-0.14
	(-4.12)	(-5.93)	(4.89)	(-0.52)
Italy	-0.13***	-0.05**	-1.45***	0.24
	(-7.75)	(-2.19)	(-9.37)	(1.57)
Japan	-0.01	0.15***	0.06	0.37
	(-1.02)	(4.52)	(0.49)	(1.36)
Netherlands	0.02***	0.01	-0.99***	-2.65***
	(4.31)	(0.16)	(-3.11)	(-2.66)
Norway	-0.03**	-0.10***	0.21	-3.22***
	(-2.10)	(-3.60)	(1.61)	(-3.44)
Portugal	0.05***	0.09***	-0.68***	1.55***
	(12.00)	(3.28)	(-14.54)	(3.65)
Spain	-0.00	-0.00	-0.62**	-0.36***
	(-0.22)	(-0.15)	(-2.51)	(-3.42)
Sweden	0.01	-0.45***	-0.30	-2.68***
	(0.68)	(-3.88)	(-1.03)	(-3.47)
Switzerland	0.02***	-0.17***	4.25***	-8.82***
	(5.28)	(-8.73)	(22.79)	(-5.73)
UK	-0.01	-0.06**	-0.18*	0.07
	(-1.32)	(-5.11)	(-1.81)	(0.51)
USA	0.02	0.23***	-0.69**	0.79***
	(1.09)	(5.19)	(-2.14)	(2.98)
Panel	0.00***	-0.04***	-0.51***	-0.37***
	(3.34)	(-6.73)	(-6.25)	(2.93)

t-values are in parenthesis; *, **, *** significant at 10, 5 and 1% respectively.

Table A1. Correlation between Wt and the OECD Wt

Country	Correlation
Australia	0.988***
Canada	0.747***
France	0.998***
Germany	-0.042
Italy	0.813***
Japan	0.895***
Sweden	0.913***
United Kingdom	0.943***
United States of America	0.925***

*, **, *** significant at 10, 5 and 1% respectively

WEALTH EFFECT IN THE US: EVIDENCE FROM BRAND NEW MICRO-DATA

Simone Salotti[÷]

Abstract

This article investigates how wealth and capital gains affected household consumption in the USA in the period 1989-2004. The empirical evidence brought so far by a large literature that investigates the role of wealth shocks on consumption is mixed, due to the low quality of the data more readily available. We use a statistical matching procedure to create our own unique dataset, merging data from the Consumer Expenditure Survey and the Survey of Consumer Finances. The high quality data that result from this operation allow us to perform a detailed analysis on the mechanism of the wealth effect. We divide between durables and non durables consumption, and we also investigate the roles of the different components of household wealth, both gross and net. Our estimates indicate that there is a significant tangible wealth effect, and its economic importance lies in the low range of the estimates of the previous empirical literature. Decomposing tangible wealth in the house of residence and other real estate leads us to conclude that both contribute to the total wealth effect, but the former is quantitatively more important. On the contrary, financial wealth seems to have no significant effects on consumption. This last finding tends to confirm the evidence found in a number of previous studies that use both micro and macro-level data. Interestingly, the effects of tangible wealth on consumption disappears in 2004, maybe because US households perceived that the rising property prices due to the housing bubble were not permanent, thus they did not modify savings. The estimation of the model with a Pooled OLS on the repeated cross sections confirms the initial findings, and, allowing for some interaction terms, permits a better understanding of the role played by aged people. The importance of tangible wealth is confirmed by this final estimation.

JEL: D12, E21

Keywords: Consumption, Household Wealth, Wealth Effect, Statistical Matching

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1. Introduction

During the Nineties and the beginning of the new Millennium, a period of growing stock and housing prices, the US aggregate savings rate fell considerably, leading to a renewed interest in the understanding of its determinants. In particular, the recent literature concentrated on the effects of household wealth on household consumption and savings, through the so called 'wealth effect' channel. This new wave of studies aimed at understanding the possible role of wealth in exacerbating the effects of a slowdown of the economy in case of constant or declining share and housing prices (Paiella, 2007). With the subprime mortgages crisis of the first half of 2008 and the following financial and economic crisis, this scenario, from mere hypothesis, has become reality. In light of that, the aim of our article is to explore deeply the role of household wealth on consumption and, consequently, on savings.

Greenspan (2003) credited housing wealth, realized capital gains, and home equity borrowing with shoring up the economy in the aftermath of the stock market collapse of 2000 and the recession of 2001, primarily through their effects on consumer spending. However, the mechanism through which wealth affects consumption is not yet clearly understood: while the arguments supporting a direct wealth effect are clear (changes in wealth directly cause changes in consumption through their effect on households' contemporaneous budget sets), the empirical evidence brought so far by a large literature that investigates the role of wealth shocks on consumption is mixed. Moreover, there is an indirect channel through which wealth can affect consumption: by providing a collateral for obtaining access to credit (Cynamon and Fazzari, 2008). Some authors claim that the decline in the personal saving rate (that started in the middle of the Eighties in most developed countries) is largely due to the significant capital gains in corporate equities experienced over this period (Juster et al., 2005). Others conclude that there is at best a weak evidence of a stock market wealth effect, and underline the importance of housing wealth in determining the households decisions on consumption and savings (Case et al., 2005).

In our article we investigate the role of wealth and capital gains on household consumption in the period 1989-2004 using a household-level dataset specifically built for this purpose. Two different surveys are combined together via a statistical matching procedure: the Consumer Expenditure Survey (CES) and the Survey of Consumer Finances (SCF). Basically, we use the statistical matching to impute the SCF wealth variables to the CES households, using the detailed socio-demographic variables collected in both surveys to match similar individuals. To the best of our knowledge, a similar procedure has been exploited only once previously, by Bostic et al. (2009). However, our analysis differs considerably from theirs, because of a completely different method chosen to perform the statistical matching that allows us to use a larger amount of information from

the surveys. As a result, our dataset is considerably larger than theirs, and we do not limit ourselves to the analysis of home owners only. Also, we use a richer set of variables, including some on past capital gains differentiated by type of asset. Finally, our analysis includes the year 2004, while Bostic et al. (2009) have data up to 2001 only.

As it is now standard in the wealth effect literature, we differentiate between financial and tangible wealth, as well as between gross and net wealth. Furthermore, we use information on past capital gains to investigate their direct role on consumption, as suggested by Juster et al. (2005). This direct investigation of the effects of capital gains on consumption has been used in early studies (Bhatia, 1972, Peek, 1983), while more recent work has focused on wealth-based models. We have chosen to perform both, even if the results of the capital gains specification are more prone to suffer from measurement errors. In fact, capital gains in the SCF are reported with a lower precision with respect to the wealth stock variables.

The main result of our study is that tangible wealth is the only type of household wealth to significantly and positively affect consumption. In particular, the house of residence is the part of tangible wealth which is responsible for the highest direct wealth effect. However, the estimated elasticity of consumption spending with respect to tangible wealth is low, being it around .02. These results demonstrate that the fears of sizable reverse direct wealth effects due to a sudden declines in housing values could have been overstated in previous studies (one exception being Case and Quigley, 2008). In fact, the dynamics of the recent economic and financial crises do not reveal any direct linkage between the declining housing prices and household consumption, rather they shed light on the perverse mechanisms of the real estate and credit (mortgages in particular) markets.

The rest of this paper is organized as follows. Section 2 provides a review of the previous literature. Section 3 describes the data used and how they were combined. Also, the econometric models are presented. Section 4 illustrates the results. Section 5 concludes briefly.

2. Previous findings

There is a large literature about the wealth effect, and most of it is based on the life-cycle model originally proposed by Ando and Modigliani (1963). According to this theory, an increase in wealth leads the individuals to gradually increase consumption, thus lowering their savings. However, Lettau and Ludvigson (2004) stress that wealth shocks must be perceived as permanent in order to affect consumption. The wealth effect has been empirically tested in a number of articles that make use either of panels of individuals or of time series data, and a wide range of different estimates have been produced. For the U.S economy, they usually lie between 2 and 7 cents of additional consumption per year per 1 dollar increase in household net wealth. This is consistent with the

magnitude of the effect estimated by the research staff of the Board of Governors of the Federal Reserve System, that maintains the longest and most regularly updated wealth effect estimates for the USA.

In the latest studies, different results have been found according to the type of household wealth analysed, mainly dividing between house equity and financial wealth. The reason lies in the fact that households may perceive these two kinds of wealth differently under many points of view, and this may influence the way it affects consumption (see Case et al., 2005, for an excellent discussion). The empirical evidence seems to confirm this intuition, and even go beyond that. For example, Edison and Sløk (2002) further differentiate financial wealth between technology and non-technology segments of the stock market, finding differences in the wealth effect channel for the USA. Case et al. (2005) study both the financial and the housing wealth effect for the US, finding a significant effect for the latter only. Bostic et al. (2009), in the paper which is most closely related to ours, disaggregate household wealth in financial, house of residence and other real estate, finding different results accordingly. Other authors concentrate either on the first or the second component: to name a few, Belski and Prakken (2004) and Carroll et al. (2006) study the housing wealth effect, while Davis and Palumbo (2001) concentrate on the financial wealth effect.[1]

The assessment of the importance of the effects of wealth on consumption is mainly an empirical issue, thus the quality of the data used in the analysis is of primary importance. This is crucial also because of the endogeneity problems that characterize this kind of analysis. Since it is hard to think about proper instruments, that is variables that are correlated with wealth but at the same time are not correlated with unobservables correlated with consumption, we have to rely on the quality of the data and on robustness checks to assess the goodness of the analysis. From this point of view, a common weakness of the articles that investigate the wealth effect is that they use either aggregate data or non accurate household-level data. In the first case there are some well known problems, such as aggregation issues and difficulties in decomposing age, cohort and time effects, as it is well explained by Attanasio and Banks (2001). About the second case, even if there are many sources of household-level data for the USA, each one of them, taken singularly, has some drawbacks for the type of analysis that is considered here. The Panel Study of Income Dynamics, (PSID, used by Lehnert, 2004, Juster et al, 2005), contains data on food consumption only, and detailed data on household wealth have been collected since 1984 every five year only. The CES (used by Dynan and Maki, 2001, to name one) has very detailed consumption data, but the quality of its wealth data is low. On the other hand, the SCF does not contain detailed consumption variables, while information on wealth is collected very accurately. In order to overcome such problems and

[1] See Paiella (2007) for an excellent survey on the empirical evidence on wealth effects.

drawbacks, the strategy of this paper is to build a new household-level dataset combining CES and SCF data, as explained in the next section.

3. Data and model

3.1 CES and SCF data

We specifically built the dataset used in this analysis in order to answer to questions related to the effects of household wealth on consumption, using two different surveys in order to collect high quality data on these two fields. The consumption data used in the estimations are provided by the CES for the period 1989-2004. The CES is collected by the Bureau of Labor Statistics to compute the Consumer Price Index, and contains data on up to 95 percent of total household expenditures. It is a rotating panel in which each household is interviewed four consecutive times over a one year period. Each quarter 25% of the sample are replaced by new households. The survey contains quarterly data, thus we had to extrapolate data on yearly consumption. Moreover, the interviews are conducted monthly about the expenditures of the previous three months: for example, a unit interviewed in January will appear in the same quarter of a unit interviewed in February or March, even if the reported information will cover a slightly different period of time. This overlapping structure of the sample complicates the operation of estimating annual consumption in many dimensions. First, the year over which we have information for each household is different depending on the month in which the household completes its cycle of interviews. Second, and even more important, not all households complete the cycle of four interviews, thus they don't report all the expenditures made in one year.

In order not to waste a vast amount of information, we have chosen to use the data of the households present for the whole year of reference, as well as the data of the households that were interviewed three periods or less, using the following procedure. First, we harmonized the expenditure variables using the Consumer Price Index, differentiated for food, energy and the other goods, in order to have all expenditures expressed with the prices of June of the reference year. Second, we deseasonalized the quarterly measures of consumption using the ratio to moving average method. Finally, we used a simple technique to extend these corrected quarterly expenditures to the whole year of interest: we multiplied by four the expenditure of the households present for one quarter only, by two the expenditure of two quarters and by four thirds the expenditure of the households interviewed for three quarters. For the households that were present for four quarters in a row, we just had to compute the sum across quarters. Thanks to this procedure, we were able to obtain a dataset with more than 17,000 households for the year 2004. We checked

whether this operation led to a dataset differing from the original (quarterly) one in terms of distributions of the variables that we used in our analysis, finding no significant difference. For each household, in addition to the expenditure variables, both for durable and for non-durable goods, we kept socio-demographic variables and annual income.[2]

The household wealth data that we imputed to the CES households come from the SCF, which is triennial and is produced by the Federal Reserve Board. This survey also includes socio-demographic information that proved valuable for the statistical matching procedure, as well as for the estimation of the consumption models. In particular, we used data on marital status, race, age, education and occupation of the household head, home ownership status and family size. The period covered by the analysis starts in 1989, mainly because the SCF question frame was different in earlier periods, and ends in 2004, with 6 observations in total. Moreover, we used the information contained in all the five implications of the SCF (implications that derive from the multiple imputation procedure used to approximate the distribution of missing data, as explained in Kennickell, 1998), by performing the statistical matching with the CES separately for each implication. To correctly take into account multiple imputation, the estimation of the consumption models were then carried out using Repeated Imputation Inference (RII), as explained by Montalto and Sung (1996).

3.2 The statistical matching procedure

The procedure used to perform the statistical matching between the two surveys is the following. We first partitioned both samples into cells based on six categorical variables in order to avoid to match individuals that differ in important characteristics. For the year 2004, more than 700 cells were created using:

* Race - white, black or other;
* Marital status - married or not;
* Education - twelfth grade or less, high school, some college or more;
* Tenure - home owner or not;
* Occupation - not working, managers and professionals, technicians, services, operators, other;
* Family size - one, two, three or four or more people in the household.

Thanks to this highly detailed partition that took into account many different variables, we were able avoid the risk of matching pairs of households differing in fundamental characteristics. Within

[2] We had to make many decisions about when to drop households for which socio-demographic variables changed from one quarter to another. For example, we dropped the households for which the marital status changed, since we wanted to get rid from the effects of weddings and divorces. In cases of less dramatic changes, we have been more parsimonious. For example, when the educational status changed from one quarter to another, we chose to keep the household and to use the educational status of the quarter closer to the central quarter of the year.

every cell, we performed a multivariate propensity score matching based on Mahalanobis distance that took into account age and income, both in logarithmic form. We also refined the matching by dropping the individuals for which the distance function displayed too high value, that is, the matched individuals had non-deniable differences in age and/or income to be paired together.[3] The matching process yielded a dataset with more than 14000 observations in 2004. In order to perform a very precise matching, we deliberately decided not to use age as a categorical variable (building 5 or 10 year groups, as it has been done in a number of previous empirical works), something that would have left income as the only variable to be used in the propensity score matching. In particular, suppose we used 10 year age groups, dividing between individuals that are 21-30 years old, 31-40 years old and so on. In this case it would have been possible to match a 30 years old household with a 21 years old control, even if a 31 years old control (with equal income) would have been a better choice. By using age together with income for the propensity score matching, we avoid such possibility and we minimize the distance between potential controls of the SCF and "treated" individuals of the CES (treated in the sense that we imputed to them the wealth variables).

We checked the result of the matching procedure in two different ways. We verified the similarity among the correlations between income (which is measured in both surveys) and the wealth variables both in the SCF and in the CES after the matching. They are reported in Table 1.

The signs and the significance levels are very close across the two surveys, and this is a sign of the good quality of the procedure. Furthermore, we produced the graphs of the probability density functions of the matched variables obtained with a kernel density estimation, finding comfortingly similar curves. Figures 1-6 reports the graphs for household net wealth: we have chosen to report this variable because it comprehends both assets and debt, therefore it summarizes more than other variables the results of the matching procedure. The two distributions do not completely overlap because not all the SCF individuals are used as controls in the matching procedure, but the curves do show very similar patterns, again making sure that the matching procedure maintained the distributional properties of the variables of interest.

We used these precautions because our application of the propensity score matching is different from the one for which it has been developed, that is, when there is the need to evaluate differences between a treatment group and a control group (Rosembaum and Rubin, 1983). Nonetheless, some national institutes of statistics have recently started to use propensity score matching to integrate different sources of information as we did, demonstrating the feasibility of this additional use

[3] In particular, we dropped the households that fell into the top 15% of the distribution of the distance variable. We also had to build a different distance function for the groups with one or two individuals only from either one or the other survey, using the normalized logarithmic income and age, and we dropped the top 20% of households matched according to this second, and rougher, algorithm.

(D'Orazio et al., 2006). However, researchers must be careful when using this method, since there are some conditions that have to be met in order to proceed with the matching. First, the two different surveys must be two samples drawn from the same population. Second, there must be a set of common variables on which to condition the matching procedure. In our case, the first condition seems easy to be met, since both the CES and the SCF should both represent the US population. However, their sample designs are different, since the SCF oversamples households that are likely to be wealthier, while the CES does not. This leads to differences in the distributions of the variables of interest (*in primis,* income), and that is why we had to get rid of the wealthiest households present in the SCF in order to get comparable income distributions between the two surveys (in particular, we dropped a percentage between 20 and 30% of the sample households with the highest income depending on the year of reference[4]). About the second condition, there are many socio-demographic variables that are collected in both surveys, and the only problem here is to recode the variables in order to have them measured in the same scale. This has been carried out making a large use of the documentation that accompanies the public releases of the two surveys. The majority of these operations of recoding were elementary. The most interesting exception has been the recoding of the occupational sector variable for the 1989 and 1992 waves of the CES, where there is an additional category, "self-employed", that in the SCF is not taken into account. In this case we performed a multinomial logit estimation to impute the occupational sector to the CES individuals labeled as "self-employed" in order to proceed with the matching with the SCF. The estimation results were in line with the distributions of the occupational variable both in the SCF and in the subsequent editions of the CES.

Finally, the matching method is based on the (critical) conditional independence assumption (CIA). Given two surveys, the first containing the variables Y and X and the other one containing the variables X and Z, the CIA states that Y and Z are independent conditionally on X. To guard against the possibility of errors deriving from the possible violation of this assumption and driving the results of the regressions, we use bootstrapped errors. Additionally, our bootstrap procedure takes into account the complex survey design of the CES, and above all, its probability weights, whose importance is well explained by Rao et al. (1992)[5].

[4] However, we also performed the statistical matching procedure without this preliminary operation and the resulting dataset did not differ dramatically from the one that we used. This is not surprising, because the Mahalanobis procedure discards the SCF households that differ considerably from the CES households in terms of income (and age), so that most of the preliminarily dropped SCF individuals would have been discarded anyway by the matching algorithm.

[5] The procedure was performed with the bsweights Stata routine, written by Stas Kolenikov.

3.3 The model

Following the literature on life cycle consumption, the basic specification of our model is the following:

$$\log(C) = \beta_1 \log(Y) + \beta_2 \log(fin) + \beta_3 \log(nfin) + \alpha' Z + \varepsilon \qquad (1)$$

where C is total consumption, Y is current income, *fin* is gross financial assets, *nfin* is tangible assets and Z is a vector of additional socio-demographic controls. In Z there are: age, educational level, a dummy for the marital status (married or with a partner/single), two dummies for the race (one for African Americans, the other for non-Whites) and a dummy for the occupational status (working/not working) of the household head; the number of persons in the household; a dummy for the homeownership status; and three different dummies for the US geographical area (Northeast, Midwest and South, with West being the reference region). While the regional dummies are supposed to capture macroeconomic factors, the other variables capture life cycle effects that are likely to affect consumption. In our analysis we used a number of different specifications, in order to investigate the role of the different components of household wealth (equation (2)), the importance of net compared to gross wealth (equation (3)), the effects on durables and non-durables consumption only, the effects of capital gains instead of the stocks of wealth (equation (4)). The specifications are the following:

$$\log(C) = \beta_1 \log(Y) + \beta_2 \log(fin) + \beta_3 \log(house) + \beta_4 \log(ore) + \alpha' Z + \varepsilon \qquad (2)$$

where tangible assets are disaggregated into *house*, the value of the house of residence, if owned, and *ore*, the value of other real estate properties.

$$\log(C) = \beta_1 \log(Y) + \beta_2 \log(netfin) + \beta_3 \log(house) + \beta_4 \log(ore) + \alpha' Z + \varepsilon \qquad (3)$$

where *netfin* is financial assets diminished by household debt.

$$\log(C) = \beta_1 \log(Y) + \beta_2 \log(kgbus) + \beta_3 \log(kgstmf) + \beta_4 \log(kghouse) + \beta_5 \log(kgore) + \alpha' Z + \varepsilon \qquad (4)$$

where *kgbus* is capital gains on business activities, *kgstmf* on stocks and mutual funds, *kghouse* on the house of residence and *kgore* on other real estate properties.

These four equations were also estimated with two alternative dependent variables, the logarithm of consumption of durable and non-durable goods, the latter being more relevant and, also, more closely related to most of the previous literature. In fact, the use of expenditure on durable goods poses some problems, since its timing does not match the flow of services coming from the goods. The relationship between consumption, income and wealth applies to the flow of consumption, but durable good expenditure "represents replacements and additions to a stock, rather than the service flow from the existing stock" (Paiella 2007, 198). This is why we will mainly concentrate on the results for total and, above all, non durable goods consumption.

The models described by the above equations were estimated cross-sectionally using data on 1989, 1992, 1995, 1998, 2001 and 2004. In the second part of the analysis we also estimated a model by pooling data over the six surveys, adding year dummies as well as a few interaction variables in order to better grasp the wealth and consumption dynamics of the old people. In particular, a dummy that takes the value of 1 if the household head is over 65 years old is multiplied by the income and the wealth variables. Again, the regressions were run with the three alternative dependent variables described above.

4. Results

The results from the cross-sectional estimation of equations (1-4) are reported in Tables 2-5. The standard errors are based on bootstrapping (250 replications, performed considering the sampling weights provided in the CES), and the estimations take into account the multiple imputation used in the SCF using the RII.

The results of the estimation of equation (1) are reported in tables 2a, 2b and 2c (as three different dependent variables are used). Current income significantly affected consumption in the period 1989-2004, since its coefficient is always highly significant and the estimated elasticity ranges between 0.3 and 0.5, indicating that current income plays a very important role in determining current consumption. Turning to the household wealth coefficients, an interesting result is that the different components do have different effects on consumption. In particular, financial wealth positively affected consumption (both total and non-durable) during the Nineties only, while it shows non-significant coefficients for the rest of the sample period. Probably, the model captured the effects of the stock market boom that ended in 2001. However, when significantly different from zero, the estimated elasticity of consumption to financial wealth is very low, being it close to .01. This means that only a one cent increase in consumption is associated to a one dollar increase in financial wealth, well below most of the previous estimates that found significant effects of this kind of wealth on consumption. On the contrary, tangible wealth positively affects consumption

throughout the whole period of interest, even if the estimated elasticity is, again, very low (close to .01). However, we investigate better the effects of tangible wealth in the following specifications, where we disaggregate it and where we also take into account debt considerations. As a final consideration on the estimation of equation (1), the surprising wealth coefficients of Table 2c (in terms both of signs and of statistical significance, compared to the tables 2a and 2b) confirms the fact that durable goods expenditure should not be used as the dependent variable in this kind of analysis. Therefore, we disregard the results with this dependent variable in the rest of the discussion.

Tables 3a and 3b show the results of the estimation of equation (2), when tangible wealth is disaggregated into the value of the house of residence and the value of other real estate. While the results confirm the previous findings on financial wealth, they show that there are significant differences in the way in which the value of the house of residence affects consumption, with respect to the rest of the tangible properties owned by the household. The estimated elasticity for the value of the house of residence is from three to five times larger than the one of the other real estate. Moreover, while the latter has comparable values across the whole sample period, the estimated elasticity for the house of residence is considerably larger for the last two periods, 2001 and 2004. As in the case of the financial wealth coefficients of the Nineties, this does not come as a complete surprise, because of the well known housing prices bubble that started in 2000 and abruptly ended with the start of the recent financial crisis, in the second half of 2007. The estimated wealth effect of the house of residence in 2004 is .03, a value that still lies in the low range of the previous literature estimates.

Tables 4a and 4b introduce debt considerations in the analysis, because net financial wealth is considered instead of gross financial assets (equation (3)). The results confirm the above findings for tangible wealth, while they confound the picture for the financial wealth effects. The estimated coefficients for this variable remain close to zero, but they are statistically significant in different periods depending on the dependent variable used: there is a significant effect in the first two periods when considering total consumption, but in the last two when considering non-durables consumption. However, since the estimated elasticity is in all cases very low, we see this results as a confirmation of the negligible role of financial wealth in determining consumption patterns.

Tables 5a and 5b show the results of the estimation of equation (4), with capital gains as the wealth variables of interest. As anticipated above, we did not expect to find important results from this estimation, since capital gains variables are more prone than the wealth variables to severe measurement errors that can compromise the estimation of the model. Indeed, this is confirmed by

the estimated coefficients. For all the four different types of capital gains, the associated coefficients are always close to zero, and most of the time they are not different from zero at standard levels.

To conclude on the cross-sectional estimates, some considerations on the other explanatory variables of the model are now presented. Most of them have significant coefficients throughout all the specifications. This is not surprising, since a satisfactory R squared is reached in all estimations. Some results are particularly interesting and confirm previous literature findings. For instance, the dummy that indicates that the household head is an Afro-American is always negative and economically important. A similar effect is also found for the dummy that indicates that the household lives in a rented house. The results conform to the previous literature also when they show that higher education is associated to higher consumption. The non trivial relationship between age and consumption is confirmed by the high statistical significance of the coefficients of age and age squared (the first positive, the second lower and negative). Finally, the regional dummies are often associated to significant and negative coefficients, a fact that must be read bearing in mind the region of reference (that is, whose dummy is not included) is West. Another interesting fact is the coefficient associated to the dummy that indicates that the household head does not work, which shows that such a condition is associated with a lower consumption, even controlling for income.

We now turn to the estimation of the pooled cross sections, shown in Tables 6 (equation (2)) and 7 (for the model of equation (3)).[6] The results confirm the findings of the cross-sectional estimates, with the bigger importance of tangible wealth with respect to financial wealth, and the higher elasticity coming from the value of the house of residence with respect to the rest of the tangible assets. The year dummies presents highly significant coefficients, confirming that consumption patterns are sensitive to macroeconomic conditions. This final estimation also permits a better investigation of the behavior of aged households, thanks to some interaction terms that try to better grasp the consumption dynamics of the households with the household head aged more than 65 years old. Concentrating on the case where non-durables consumption is the dependent variable, it seems that old people experience a higher wealth effect from the value of the house of residence, while they have a lower income elasticity.

We investigated the robustness of this findings in a few ways. We found that the results hold when we restrict our sample to urban households only (they are almost 90% of the sample). The same is true when we get rid of the 1% of household that are at the top and at the bottom both of the income

[6] We thought about adopting pseudo-panel techniques *à la* Deaton (1985), but due to the construction of our dataset with a statistical matching procedure, we found it difficult to apply additional methods to manipulate the data and introduce additional assumptions.

and of the consumption distributions. This robustness is not surprising, since our sample is very large, and it is unlikely that our results are driven by outliers or by small subsamples of households.

5. Conclusions

This paper analyses the strength of the wealth effects on consumption in the USA with a dataset specifically built for this scope. A sophisticated statistical matching procedure was used to merge data of the CES and the SCG for the years 1989-2004. In particular, SCF wealth data were imputed to CES units in order to perform an analysis capable to link consumption and wealth using household-level data. This application of statistical matching is relatively recent in the economic literature, and was first used by national institutes of statistics. The matching procedure produced a large dataset capable to respect the properties of the distributions of the variables of interest present in each of the two original survey. The resulting dataset was then used to estimate four different specifications of a simple consumption model. The effects of wealth were investigated using three different dependent variables: total, durables and non durables consumption. The latter is the most correct measure of consumption to be used in this kind of analysis. Also, our dataset permits a high disaggregation of tangible wealth, as well as a differentiation between net and gross financial wealth. Two kinds of estimations are performed. First, the models were estimated for each cross-section. Then, a final estimation was carried out on the pooled cross-sections, something that allow the use of some interesting interaction terms. The results show that tangible wealth positively affected household consumption in the USA in the period 1989-2004. The estimated elasticity (.02) lies in the low range of what constitutes the consensus on how asset market gains affect consumer spending in the USA. It seems that households tend to consume both out of their house of residence and out of their other real estate properties, even if the former is more important of the latter. On the other hand, the results suggest that financial wealth does not exert any direct effect on household consumption. This piece of evidence adds to the mixed results of the previous literature, where the widest range of results has been found for this kind of wealth. These results are confirmed both by the cross-sectional estimates and by the estimation of the pooled cross-sections.

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Figures

Figure 1: Household net wealth kernel distribution, 2004

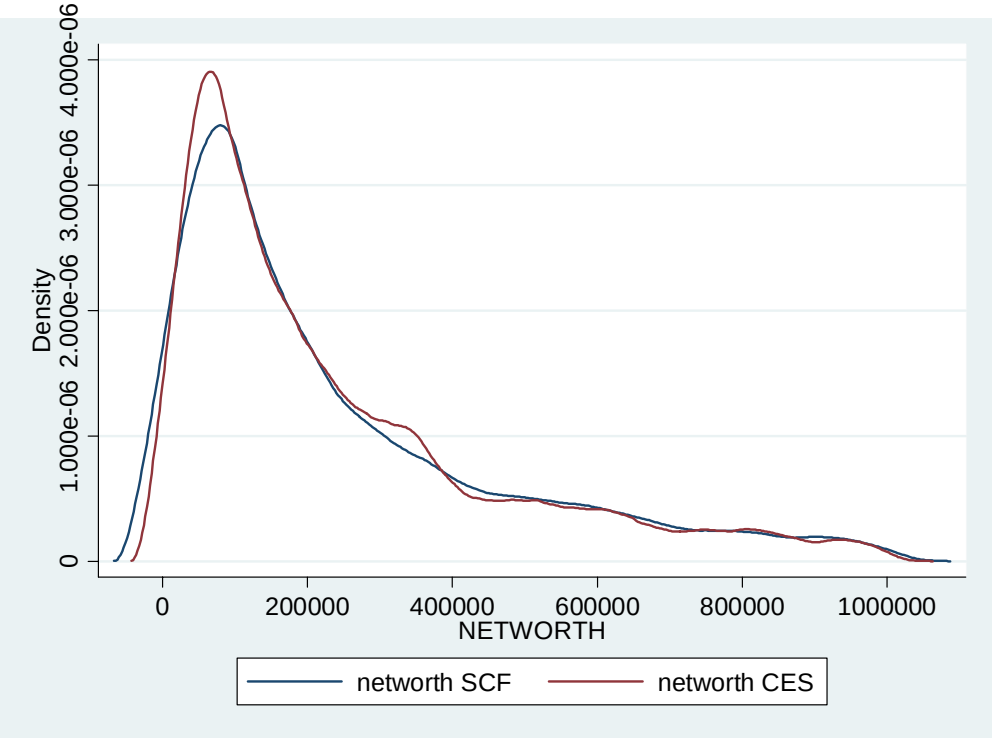


Figure 2: Household net wealth kernel distribution, 2001

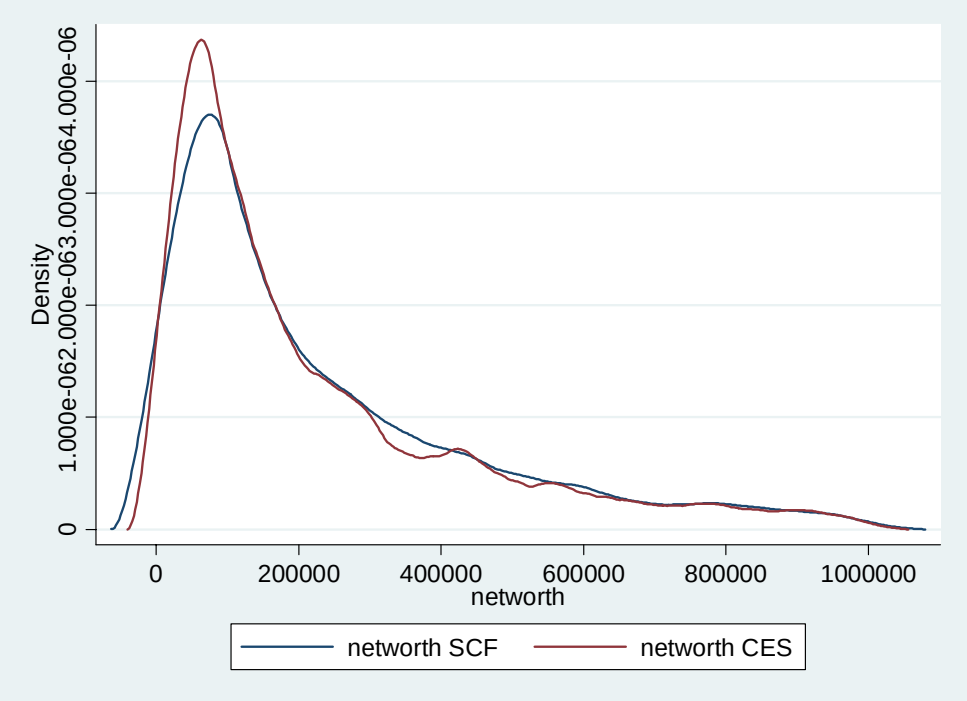


Figure 3: Household net wealth kernel distribution, 1998

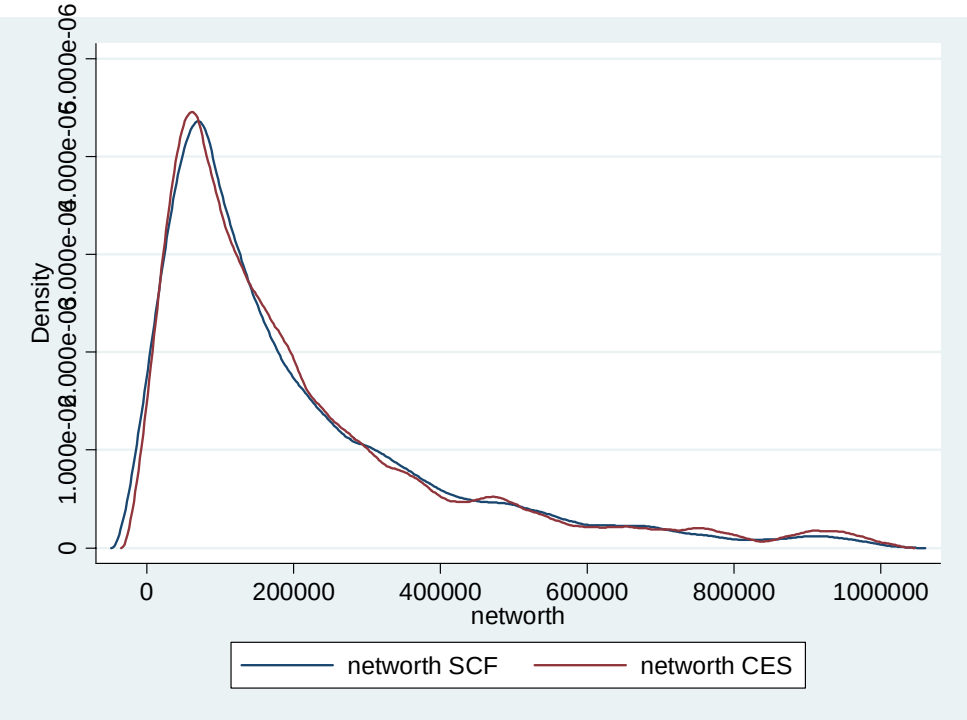


Figure 4: Household net wealth kernel distribution, 1995

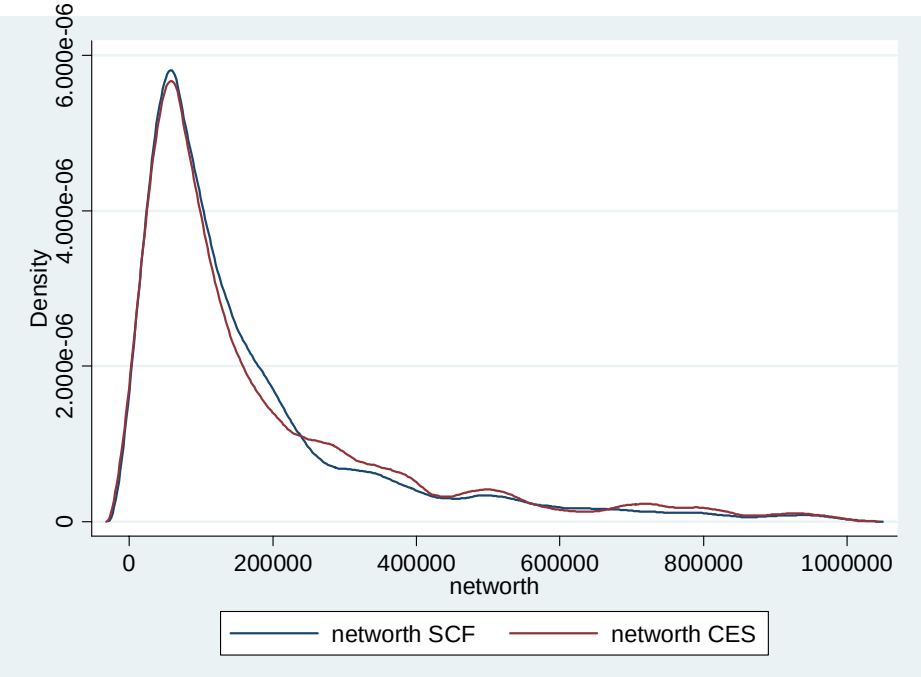


Figure 5: Household net wealth kernel distribution, 1992

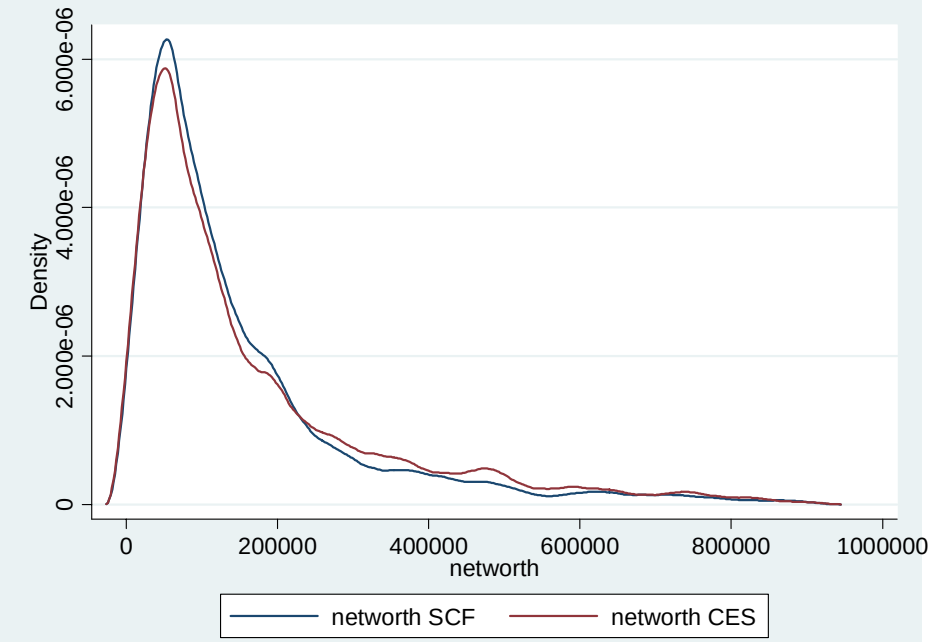
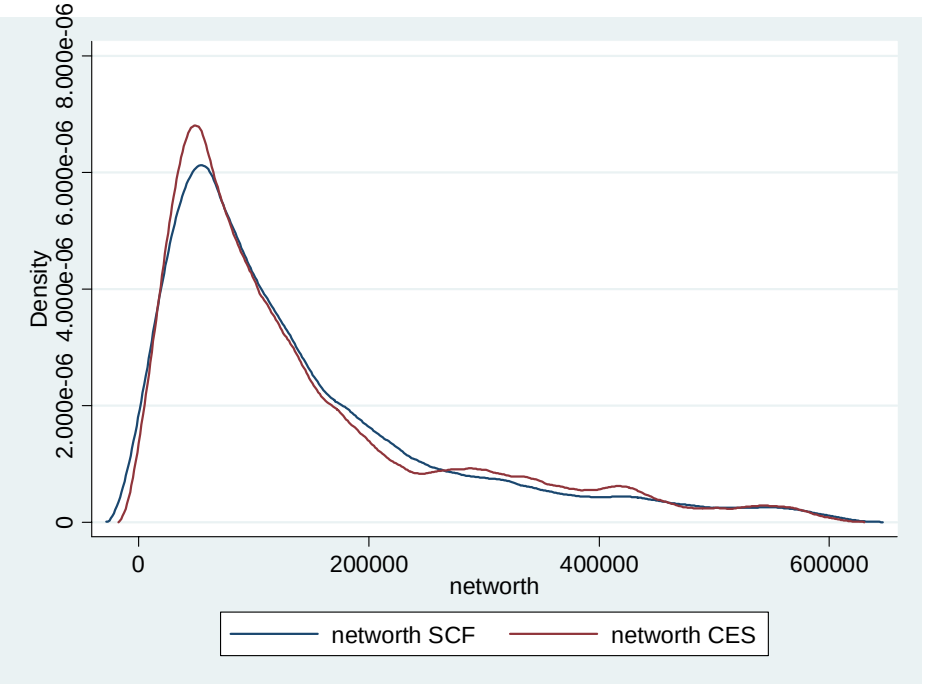


Figure 6: Household net wealth kernel distribution, 1989



Tables

Table 1: correlations between logarithmic income and the wealth (SCF) variables

	2004		2001		1998	
	SCF	CES	SCF	CES	SCF	CES
fin	0.26***	0.18***	0.27***	0.14***	0.22***	0.11**
nfin	0.25***	0.26***	0.24***	0.18***	0.19***	0.17***
asset	0.30***	0.26***	0.31***	0.20***	0.25***	0.17***
debt	0.41***	0.40***	0.47***	0.42***	0.38***	0.29***
networth	0.28***	0.23***	0.29***	0.18***	0.23***	0.16***
kgtotal	0.18***	0.15***	0.18***	0.09**	0.13***	0.12**
	1995		1992		1989	
	SCF	CES	SCF	CES	SCF	CES
fin	0.18***	0.12**	0.24***	0.19***	0.25***	0.08***
nfin	0.20***	0.09**	0.16***	0.09***	0.21***	0.10***
asset	0.24***	0.12***	0.21***	0.11***	0.27***	0.13***
debt	0.32***	0.29***	0.28***	0.14	0.39***	0.33***
networth	0.22***	0.10***	0.19***	0.10***	0.25***	0.12***
kgtotal	0.14***	0.04**	0.12***	0.07***	0.15***	0.06***

*** / ** / *: p-value <0.01 / 0.05 / 0.10

Table 2a: equation (1), Total Consumption

	1989	1992	1995	1998	2001	2004
Income	0.431***	0.393***	0.322***	0.370***	0.397***	0.536***
	(0.013)	(0.015)	(0.014)	(0.011)	(0.010)	(0.010)
Fin. Assets	0.002	-0.000	**0.008*** **	**0.005** **	0.004	-0.000
	(0.003)	(0.003)	**(0.003)**	**(0.002)**	(0.002)	(0.002)
Non Fin. Assets	**0.007** **	**0.007*** **	**0.010*** **	**0.006*** **	**0.007*** **	0.003
	(0.003)	**(0.003)**	**(0.003)**	**(0.002)**	**(0.002)**	(0.002)
Race-Black	-0.096***	-0.092***	-0.048**	-0.056***	-0.058***	-0.056***
	(0.023)	(0.022))	(0.023)	(0.018)	(0.017)	(0.014)
Race-Other	-0.052	-0.034	-0.060	-0.032	-0.021	-0.022
	(0.040)	(0.037)	(0.037)	(0.033)	(0.027)	(0.022)
Single	-0.157***	-0.127***	-0.167***	-0.149***	-0.132***	-0.084***
	(0.018)	(0.016)	(0.017)	(0.014)	(0.012)	(0.011)
Educated	0.101***	0.097***	0.109***	0.095***	0.097***	0.068***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.004)
Age	0.020***	0.017***	0.017***	0.018***	0.013***	0.010***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	-0.036**	-0.080***	-0.083***	-0.051***	-0.085***	-0.025
	(0.018)	(0.017)	(0.020)	(0.015)	(0.015)	(0.016)
Not working	-0.108***	-0.128***	-0.080***	-0.084***	-0.035**	-0.015
	(0.021)	(0.021)	(0.023)	(0.018)	(0.016)	(0.016)
Northeast	-0.017	-0.022	0.021	0.009	-0.043***	-0.102***
	(0.017)	(0.017)	(0.017)	(0.015)	(0.015)	(0.014)
Midwest	-0.077***	-0.098***	-0.026	-0.066***	-0.061***	-0.092***
	(0.016)	(0.016)	(0.017)	(0.014)	(0.013)	(0.012)
South	-0.057***	-0.051***	-0.010	-0.063***	-0.088***	-0.133***
	(0.017)	(0.016)	(0.018)	(0.013)	(0.013)	(0.011)
Family size	0.540***	0.064***	0.068***	0.066***	0.069***	0.053***
	(0.112)	(0.112)	(0.005)	(0.005)	(0.004)	(0.004)
Constant	4.960***	5.474***	6.105***	5.644***	5.603***	4.293***
	(0.126)	(0.138)	(0.143)	(0.112)	(0.104)	(0.109)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.67	0.66	0.63	0.60	0.60	0.63

Table 2b: equation (1), Non-Durables Consumption

	1989	1992	1995	1998	2001	2004
Income	0.399***	0.367***	0.311***	0.363***	0.389***	0.520***
	(0.012)	(0.015)	(0.014)	(0.011)	(0.009)	(0.012)
Fin. Assets	0.000	**0.006****	**0.008*****	**0.004***	**0.005***	0.001
	(0.003)	**(0.003)**	**(0.003)**	**(0.002)**	**(0.002)**	(0.002)
Non Fin. Assets	**0.010*****	**0.007****	**0.012*****	**0.007*****	**0.007*****	**0.006****
	(0.003)	**(0.003)**	**(0.004)**	**(0.002)**	**(0.002)**	**(0.003)**
Race-Black	-0.059***	-0.045**	-0.014	-0.050***	-0.045***	-0.058***
	(0.023)	(0.022)	(0.022)	(0.017)	(0.017)	(0.015)
Race-Other	-0.070	-0.033	-0.034	-0.024	-0.057**	-0.064**
	(0.042)	(0.046)	(0.037)	(0.033)	(0.027)	(0.030)
Single	-0.140***	-0.126***	-0.149***	-0.126***	-0.134***	-0.111***
	(0.016)	(0.016)	(0.016)	(0.013)	(0.011)	(0.011)
Educated	0.094***	0.091***	0.104***	0.089***	0.100***	0.071***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.004)
Age	0.015***	0.016***	0.013***	0.014***	0.011***	0.005***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	-0.101***	-0.145***	-0.151***	-0.130***	-0.153***	-0.098***
	(0.017)	(0.017)	(0.019)	(0.015)	(0.014)	(0.018)
Not working	-0.105***	-0.111***	-0.089***	-0.083***	-0.041***	-0.038***
	(0.020)	(0.020)	(0.022)	(0.017)	(0.016)	(0.017)
Northeast	0.041**	0.045***	0.072***	0.048***	-0.031**	-0.075***
	(0.016)	(0.017)	(0.017)	(0.015)	(0.014)	(0.014)
Midwest	-0.027*	-0.031*	0.050***	0.001	-0.022*	-0.043***
	(0.015)	(0.016)	(0.017)	(0.013)	(0.013)	(0.012)
South	-0.003	0.009	0.050**	0.007	-0.059***	-0.086***
	(0.015)	(0.016)	(0.017)	(0.012)	(0.012)	(0.012)
Family size	0.068***	0.076***	0.077***	0.072***	0.065***	0.055***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
Constant	4.77***	5.148***	5.669***	5.241***	5.171***	3.993***
	(0.125)	(0.139)	(0.141)	(0.107)	(0.095)	(0.119)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.68	0.66	0.65	0.63	0.63	0.63

Table 2c: equation (1), Durables Consumption

	1989	1992	1995	1998	2001	2004
Income	0.537***	0.507***	0.370***	0.447***	0.461***	0.661***
	(0.024)	(0.029)	(0.021)	(0.019)	(0.017)	(0.020)
Fin. Assets	0.006	**-0.013****	**0.008***	0.001	0.001	-0.005
	(0.006)	**(0.006)**	**(0.005)**	(0.005)	(0.004)	(0.004)
Non Fin. Assets	**-0.009***	0.007	**0.012***	**0.009****	**0.007***	0.002
	(0.005)	(0.006)	**(0.006)**	**(0.004)**	**(0.004)**	(0.005)
Race-Black	-0.161***	-0.181***	-0.107**	-0.068*	-0.090***	-0.067**
	(0.044)	(0.045)	(0.045)	(0.035)	(0.032)	(0.029)
Race-Other	-0.058	-0.072	-0.170**	-0.113	-0.017	-0.037
	(0.065)	(0.064)	(0.077)	(0.073)	(0.045)	(0.046)
Single	-0.247***	-0.129***	-0.199***	-0.187***	-0.150***	-0.042**
	(0.037)	(0.027)	(0.028)	(0.024)	(0.021)	(0.021)
Educated	0.132***	0.111***	0.124***	0.111***	0.113***	0.082***
	(0.014)	(0.010)	(0.011)	(0.009)	(0.008)	(0.008)
Age	0.053***	0.034***	0.034***	0.036***	0.030***	0.029***
	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	0.161***	0.084**	0.079**	0.144***	0.076***	0.168***
	(0.034)	(0.034)	(0.033)	(0.027)	(0.027)	(0.027)
Not working	-0.101**	-0.147***	-0.071*	-0.067**	-0.023	0.026
	(0.042)	(0.037)	(0.041)	(0.031)	(0.027)	(0.029)
Northeast	-0.149***	-0.150***	-0.067**	-0.049*	-0.066***	-0.147***
	(0.035)	(0.030)	(0.030)	(0.029)	(0.025)	(0.025)
Midwest	-0.138***	-0.221***	-0.155***	-0.130***	-0.138***	-0.168***
	(0.030)	(0.030)	(0.029)	(0.025)	(0.023)	(0.021)
South	-0.183***	-0.177***	-0.128***	-0.175***	-0.182***	-0.228***
	(0.033)	(0.029)	(0.030)	(0.025)	(0.022)	(0.020)
Family size	0.030***	0.052***	0.063***	0.070***	0.079***	0.050***
	(0.010)	(0.008)	(0.009)	(0.008)	(0.007)	(0.007)
Constant	2.317***	3.062***	4.245***	3.399***	3.534***	1.526***
	(0.271)	(0.274)	(0.237)	(0.215)	(0.203)	(0.229)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.43	0.44	0.41	0.39	0.39	0.41

Table 3a: equation (2), Total Consumption

	1989	1992	1995	1998	2001	2004
Income	0.430***	0.392***	0.320***	0.369***	0.396***	0.529***
	(0.013)	(0.015)	(0.014)	(0.011)	(0.010)	(0.010)
Fin. Assets	0.002	-0.001	**0.007****	**0.005****	0.003	-0.002
	(0.003)	(0.003)	**(0.003)**	**(0.002)**	(0.002)	(0.002)
Other real estate	**0.005****	**0.005****	**0.006****	**0.005****	**0.004****	**0.004****
	(0.002)	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**
House	0.008	**0.017*****	**0.016***	0.009	**0.011****	**0.026*****
	(0.005)	**(0.007)**	**(0.008)**	(0.007)	**(0.005)**	**(0.007)**
Race-Black	-0.100***	-0.095***	-0.054**	-0.056***	-0.060***	-0.053***
	(0.023)	(0.022)	(0.022)	(0.018)	(0.017)	(0.014)
Race-Other	-0.054	-0.036	-0.062*	-0.033	-0.022	-0.026
	(0.040)	(0.037)	(0.036)	(0.033)	(0.027)	(0.022)
Single	-0.156***	-0.124***	-0.163***	-0.145***	-0.129***	-0.079***
	(0.018)	(0.016)	(0.017)	(0.015)	(0.012)	(0.011)
Educated	0.101***	0.095***	0.108***	0.094***	0.096***	0.066***
	(0.006)	(0.006)	(0.007)	(0.005)	(0.005)	(0.004)
Age	0.019***	0.016***	0.017***	0.017***	0.013***	0.010***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	0.026	0.088	0.059	0.032	0.016	0.272***
	(0.061)	(0.076)	(0.094)	(0.075)	(0.063)	(0.078)
Not working	-0.109***	-0.130***	-0.085***	-0.085***	-0.035**	-0.016
	(0.021)	(0.021)	(0.023)	(0.018)	(0.016)	(0.017)
Northeast	-0.017	-0.023	0.020	0.009	-0.043***	-0.103***
	(0.017)	(0.017)	(0.017)	(0.015)	(0.015)	(0.014)
Midwest	-0.076***	-0.098***	-0.027	-0.066***	-0.061***	-0.092***
	(0.016)	(0.016)	(0.017)	(0.014)	(0.013)	(0.012)
South	-0.056***	-0.051***	-0.009	-0.062***	-0.088***	-0.133***
	(0.017)	(0.016)	(0.018)	(0.013)	(0.013)	(0.011)
Family size	0.054***	0.063***	0.067***	0.067***	0.069***	0.052***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
Constant	4.934***	5.352***	6.022***	5.591***	5.529***	4.083***
	(0.129)	(0.150)	(0.159)	(0.121)	(0.113)	(0.112)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.67	0.66	0.63	0.60	0.60	0.63

Table 3b: equation (2), Non-Durables Consumption

	1989	1992	1995	1998	2001	2004
Income	0.397***	0.367***	0.309***	0.361***	0.388***	0.514***
	(0.013)	(0.015)	(0.014)	(0.011)	(0.009)	(0.012)
Fin. Assets	0.001	**0.006***	**0.008*****	0.003	**0.004***	0.000
	(0.003)	**(0.003)**	**(0.003)**	(0.002)	**(0.002)**	(0.002)
Other real estate	**0.005****	**0.004***	**0.007*****	**0.004****	**0.004****	**0.005****
	(0.002)	**(0.002)**	**(0.003)**	**(0.002)**	**(0.002)**	**(0.002)**
Houses	**0.015*****	**0.016*****	**0.019****	**0.017*****	**0.017*****	**0.028*****
	(0.005)	**(0.005)**	**(0.008)**	**(0.006)**	**(0.005)**	**(0.007)**
Race-Black	-0.065***	-0.049**	-0.021	-0.050***	-0.047***	-0.057***
	(0.023)	(0.022)	(0.022)	(0.017)	(0.017)	(0.015)
Race-Other	-0.074*	-0.036	-0.037	-0.027	-0.059**	-0.068**
	(0.042)	(0.046)	(0.036)	(0.033)	(0.028)	(0.030)
Single	-0.141***	-0.124***	-0.145***	-0.122***	-0.131***	-0.106***
	(0.016)	(0.016)	(0.016)	(0.013)	(0.011)	(0.011)
Educated	0.093***	0.089***	0.102***	0.088***	0.098***	0.068***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.004)
Age	0.015***	0.015***	0.013***	0.013***	0.011***	0.005***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	0.026	0.008	0.019	0.034	0.019	0.204***
	(0.058)	(0.060)	(0.092)	(0.072)	(0.058)	(0.077)
Not working	-0.108***	-0.113***	-0.096***	-0.085***	-0.041***	-0.039**
	(0.021)	(0.020)	(0.022)	(0.017)	(0.016)	(0.017)
Northeast	0.042**	0.044***	0.071***	0.048***	-0.031**	-0.075***
	(0.016)	(0.017)	(0.017)	(0.015)	(0.014)	(0.014)
Midwest	-0.026*	-0.031*	0.048***	0.001	-0.023*	-0.043***
	(0.015)	(0.016)	(0.017)	(0.013)	(0.013)	(0.012)
South	-0.002	0.009	0.051***	0.008	-0.059***	-0.085***
	(0.015)	(0.016)	(0.017)	(0.012)	(0.012)	(0.012)
Family size	0.068***	0.075***	0.076***	0.072***	0.065***	0.055***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
Constant	4.713***	5.036***	5.567***	5.125***	5.041***	3.780***
	(0.126)	(0.141)	(0.150)	(0.114)	(0.103)	(0.117)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.68	0.66	0.65	0.63	0.63	0.63

Table 4a: equation (3), Total Consumption

	1989	1992	1995	1998	2001	2004
Income	0.432***	0.393***	0.325***	0.373***	0.399***	0.526***
	(0.012)	(0.015)	(0.013)	(0.011)	(0.009)	(0.010)
Net Fin. Assets	**-0.002***	**-0.003****	0.001	0.001	0.001	0.001
	(0.001)	**(0.001)**	(0.001)	(0.002)	(0.001)	(0.001)
Other real estate	**0.005****	**0.005****	**0.008*****	**0.006*****	**0.005****	**0.004****
	(0.002)	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**
House	0.008	**0.018*****	**0.018****	**0.011***	**0.012****	**0.025*****
	(0.005)	**(0.007)**	**(0.008)**	**(0.007)**	**(0.006)**	**(0.007)**
Race-Black	-0.106***	-0.098***	-0.056**	-0.057***	-0.061***	-0.050***
	(0.023)	(0.021)	(0.022)	(0.018)	(0.017)	(0.014)
Race-Other	-0.059	-0.039	-0.065*	-0.035	-0.025	-0.025
	(0.040)	(0.037)	(0.037)	(0.033)	(0.027)	(0.022)
Single	-0.155***	-0.126***	-0.167***	-0.146***	-0.129***	-0.078***
	(0.018)	(0.016)	(0.017)	(0.015)	(0.012)	(0.011)
Educated	0.102***	0.096***	0.112***	0.097***	0.098***	0.064***
	(0.006)	(0.006)	(0.007)	(0.005)	(0.005)	(0.004)
Age	0.019***	0.016***	0.017***	0.017***	0.013***	0.010***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	0.028	0.099	0.078	0.043	0.023	0.252***
	(0.061)	(0.077)	(0.093)	(0.075)	(0.064)	(0.079)
Not working	-0.107***	-0.126***	-0.092***	-0.088***	-0.038**	-0.015
	(0.021)	(0.021)	(0.023)	(0.019)	(0.016)	(0.016)
Northeast	-0.017	-0.023	0.020	0.009	-0.043***	-0.103***
	(0.017)	(0.017)	(0.017)	(0.015)	(0.015)	(0.014)
Midwest	-0.077***	-0.098***	-0.026	-0.066***	-0.061***	-0.092***
	(0.016)	(0.016)	(0.017)	(0.014)	(0.013)	(0.012)
South	-0.055***	-0.052***	-0.010	-0.062***	-0.088***	-0.133***
	(0.017)	(0.016)	(0.018)	(0.013)	(0.013)	(0.011)
Family size	0.053***	0.062***	0.066***	0.066***	0.068***	0.053***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
Constant	4.919***	5.335***	5.981***	5.572***	5.509***	4.115***
	(0.126)	(0.151)	(0.155)	(0.119)	(0.112)	(0.109)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.67	0.66	0.63	0.60	0.60	0.63

Table 4b: equation (3), Non-Durables Consumption

	1989	1992	1995	1998	2001	2004
Income	0.398***	0.371***	0.314***	0.364***	0.391***	0.512***
	(0.012)	(0.014)	(0.013)	(0.011)	(0.009)	(0.012)
Net Fin. Assets	-0.001	0.001	0.002	0.001	**0.003****	**0.003****
	(0.001)	(0.001)	(0.001)	(0.002)	**(0.001)**	**(0.001)**
Other real estate	**0.005****	**0.005*****	**0.008*****	**0.005*****	**0.005*****	**0.005****
	(0.002)	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**	**(0.002)**
House	**0.015*****	**0.017*****	**0.022*****	**0.018*****	**0.018*****	**0.027*****
	(0.005)	**(0.005)**	**(0.008)**	**(0.006)**	**(0.005)**	**(0.007)**
Race-Black	-0.068***	-0.055**	-0.023	-0.051***	-0.046***	-0.054***
	(0.023)	(0.021)	(0.022)	(0.017)	(0.017)	(0.015)
Race-Other	-0.076*	-0.039	-0.038	-0.027	-0.062**	-0.068**
	(0.043)	(0.046)	(0.036)	(0.032)	(0.027)	(0.030)
Single	-0.141***	-0.126***	-0.149***	-0.123***	-0.132***	-0.104***
	(0.016)	(0.016)	(0.016)	(0.013)	(0.011)	(0.011)
Educated	0.093***	0.092***	0.107***	0.089***	0.099***	0.067***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.004)
Age	0.015***	0.015***	0.013***	0.013***	0.011***	0.006***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	0.027	0.019	0.037	0.040	0.023	0.188**
	(0.058)	(0.061)	(0.091)	(0.071)	(0.058)	(0.077)
Not working	-0.107***	-0.116***	-0.104***	-0.088***	-0.046***	-0.041**
	(0.021)	(0.021)	(0.022)	(0.018)	(0.016)	(0.017)
Northeast	0.042**	0.045***	0.071***	0.048***	-0.031**	-0.076***
	(0.016)	(0.017)	(0.017)	(0.015)	(0.014)	(0.014)
Midwest	-0.026*	-0.031*	0.049***	0.001	-0.023*	-0.043***
	(0.015)	(0.016)	(0.017)	(0.013)	(0.013)	(0.012)
South	-0.002	0.008	0.050***	0.008	-0.059***	-0.085***
	(0.015)	(0.016)	(0.017)	(0.012)	(0.012)	(0.012)
Family size	0.067***	0.074***	0.075***	0.072***	0.065***	0.056***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
Constant	4.708***	5.006***	5.527***	5.116***	5.022***	3.804***
	(0.123)	(0.141)	(0.146)	(0.113)	(0.101)	(0.112)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.68	0.66	0.65	0.63	0.63	0.63

Table 5a: equation (4), Total Consumption

	1989	1992	1995	1998	2001	2004
Income	0.436***	0.398***	0.329***	0.377***	0.405***	0.535***
	(0.012)	(0.014)	(0.013)	(0.011)	(0.009)	(0.010)
kg (house)	0.000	0.001	0.000	-0.001	0.000	**0.002****
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	**(0.001)**
kg (ore)	0.001	0.000	0.002	0.002	0.001	**0.002***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	**(0.001)**
kg (bus)	0.000	0.002	0.000	0.000	0.002	0.001
	(0.002)	(0.001)	(0.002	(0.002)	(0.002)	(0.001)
kg (stmf)	-0.001	0.001	**0.005*****	**0.004*****	0.000	0.001
	(0.002)	(0.002)	**(0.002)**	**(0.001)**	(0.001)	(0.001)
Race-Black	-0.108***	-0.104***	-0.070***	-0.065***	-0.067***	-0.056***
	(0.023)	(0.021)	(0.022)	(0.018)	(0.017)	(0.014)
Race-Other	-0.057	-0.040	-0.065*	-0.035	-0.027	-0.022
	(0.040)	(0.037)	(0.037)	(0.033)	(0.027)	(0.022)
Single	-0.164***	-0.129***	-0.181***	-0.153***	-0.132***	-0.081***
	(0.018)	(0.016)	(0.017)	(0.015)	(0.012)	(0.011)
Educated	0.104***	0.098***	0.116***	0.097***	0.100***	0.068***
	(0.006)	(0.006)	(0.007)	(0.005)	(0.005)	(0.004)
Age	0.020***	0.017***	0.017***	0.018***	0.013***	0.010***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	-0.062***	-0.098***	-0.133***	-0.088***	-0.119***	-0.015
	(0.019)	(0.017)	(0.017)	(0.014)	(0.016)	(0.015)
Not working	-0.115***	-0.130***	-0.100***	-0.093***	-0.040**	-0.013
	(0.021)	(0.021)	(0.023)	(0.019)	(0.016)	(0.016)
Northeast	-0.017	-0.025	0.021	0.009	-0.044***	-0.102***
	(0.017)	(0.017)	(0.017)	(0.015)	(0.015)	(0.014)
Midwest	-0.077***	-0.100***	-0.027	-0.066***	-0.062***	-0.091***
	(0.016)	(0.016)	(0.017)	(0.014)	(0.013)	(0.012)
South	-0.056***	-0.053***	-0.010	-0.063***	-0.089***	-0.133***
	(0.017)	(0.016)	(0.018)	(0.013)	(0.013)	(0.011)
Family size	0.053***	0.064***	0.065***	0.066***	0.069***	0.053***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)
Constant	5.000***	5.500***	6.194***	5.691***	5.614***	4.313***
	(0.124)	(0.138)	(0.139)	(0.113)	(0.104)	(0.107)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.67	0.66	0.63	0.60	0.60	0.63

Table 5b: equation (4), Non-Durables Consumption

	1989	1992	1995	1998	2001	2004
Income	0.402***	0.378***	0.318***	0.367***	0.397***	0.523***
	(0.012)	(0.014)	(0.013)	(0.010)	(0.008)	(0.011)
kg (house)	0.002	**0.003*** **	0.001	0.001	0.001	**0.003*** **
	(0.001)	**(0.001)**	(0.001)	(0.001)	(0.001)	**(0.001)**
kg (ore)	0.002	0.002	**0.004***	**0.002***	**0.004*** **	**0.003*** **
	(0.001)	(0.002)	**(0.002)**	**(0.001)**	**(0.002)**	**(0.001)**
kg (bus)	-0.001	0.002	0.001	0.002	**0.003** **	0.001
	(0.001)	(0.001)	(0.002)	(0.001)	**(0.001)**	(0.001)
kg (stmf)	0.001	0.002	**0.005** **	**0.004*** **	-0.001	0.002
	(0.002)	(0.002)	**(0.002)**	**(0.001)**	(0.001)	(0.001)
Race-Black	-0.073***	-0.066***	-0.038*	-0.057***	-0.052***	-0.062***
	(0.022)	(0.021)	(0.021)	(0.017)	(0.016)	(0.015)
Race-Other	-0.073*	-0.044	-0.039	-0.025	-0.065**	-0.065**
	(0.042)	(0.046)	(0.036)	(0.032)	(0.027)	(0.030)
Single	-0.149***	-0.131***	-0.163***	-0.127***	-0.133***	-0.108***
	(0.016)	(0.015)	(0.016)	(0.014)	(0.011)	(0.011)
Educated	0.095***	0.095***	0.111***	0.090***	0.102***	0.072***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)	(0.004)
Age	0.015***	0.015***	0.013***	0.013***	0.011***	0.005***
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Home Renter	-0.128***	-0.154***	-0.197***	-0.157***	-0.178***	-0.098***
	(0.017)	(0.016)	(0.016)	(0.014)	(0.015)	(0.015)
Not working	-0.114***	-0.116***	-0.109***	-0.089***	-0.046***	-0.037**
	(0.021)	(0.021)	(0.022)	(0.018)	(0.016)	(0.017)
Northeast	0.041**	0.042**	0.071***	0.048***	-0.033**	-0.075***
	(0.016)	(0.017)	(0.017)	(0.015)	(0.014)	(0.014)
Midwest	-0.027*	-0.034**	0.048***	0.001	-0.024*	-0.043***
	(0.015)	(0.016)	(0.017)	(0.013)	(0.013)	(0.012)
South	-0.002	0.007	0.051***	0.008	-0.061***	-0.086***
	(0.015)	(0.016)	(0.017)	(0.012)	(0.012)	(0.012)
Family size	0.067***	0.074***	0.074***	0.073***	0.065***	0.055***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)
Constant	4.857***	5.148***	5.779***	5.301***	5.191***	4.020***
	(0.124)	(0.138)	(0.138)	(0.108)	(0.095)	(0.117)
Obs.	7344	7620	7159	9868	12178	14411
R-squared	0.68	0.66	0.65	0.63	0.63	0.63

Table 6: equation (2), three different dependent variables

	Total cons.	Non-durables cons.	Durables cons.
Income	0.400***	0.389***	0.474***
	(0.005)	(0.005)	(0.009)
Fin. Assets	**0.003*** **	**0.006*** **	**-0.004***
	(0.001)	**(0.001)**	**(0.002)**
Other real estate	**0.006*** **	**0.005*** **	**0.011*** **
	(0001)	**(0.001)**	**(0.002)**
House	**0.019*** **	**0.022*** **	**0.017*** **
	(0.003)	**(0.003)**	**(0.005)**
Race-Black	-0.067***	-0.050***	-0.097***
	(0.008)	(0.008)	(0.015)
Race-Other	-0.035***	-0.052***	-0.069***
	(0.013)	(0.014)	(0.025)
Single	-0.138***	-0.135***	-0.157***
	(0.006)	(0.006)	(0.011)
Educated	0.094***	0.091***	0.113***
	(0.002)	(0.002)	(0.004)
Age	0.015***	0.012***	0.036***
	(0.001)	(0.001)	(0.002)
Age squared	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Home Renter	0.081**	0.080***	0.112**
	(0.032)	(0.028)	(0.055)
Not working	-0.074***	-0.078***	-0.068***
	(0.008)	(0.008)	(0.014)
Family size	0.063***	0.071***	0.057***
	(0.002)	(0.002)	(0.003)
Area 1	-0.025***	0.020***	-0.110***
	(0.007)	(0.007)	(0.012)
Area 2	-0.070***	-0.009	-0.165***
	(0.006)	(0.006)	(0.010)
Area 3	-0.069***	-0.015**	-0.183***
	(0.006)	(0.006)	(0.011)
Year 1989	-0.128***	-0.153***	-0.127***
	(0.008)	(0.008)	(0.016)
Year 1992	-0.078***	-0.095***	-0.062***
	(0.007)	(0.007)	(0.014)
Year 1995	-0.023***	-0.055***	0.013
	(0.008)	(0.007)	(0.014)
Year 1998	-0.058***	-0.094***	-0.037***
	(0.007)	(0.007)	(0.013)
Year 2001	0.046***	0.032***	0.073***
	(0.006)	(0.006)	(0.011)
Old*Fin. Assets	0.000	-0.008***	0.018***
	(0.006)	(0.003)	(0.005)
Old*Other real estate	0.008***	0.005	0.002
	(0.003)	(0.003)	(0.005)
Old*House	0.001	0.019***	-0.043***
	(0.002)	(0.002)	(0.003)
Old*Income	-0.004	-0.014***	0.029***
	(0.003)	(0.003)	(0.005)
Constant	5.452***	4.912***	3.233***
	(0.060)	(0.053)	(0.111)
Obs.	58580	58580	58580
R-squared	0.64	0.66	0.42

Table 7: equation (3), three different dependent variables

	Total cons.	Non-durables cons.	Durables cons.
Income	0.403***	0.393***	0.473***
	(0.005)	(0.005)	(0.009)
Net Fin. Assets	0.000	**0.002*** **	**-0.003** **
	(0.001)	**(0.001)**	**(0.001)**
Other real estate	**0.007*** **	**0.006*** **	**0.010*** **
	(0001)	**(0.001)**	**(0.002)**
House	**0.021*** **	**0.024*** **	**0.016*** **
	(0.003)	**(0.003)**	**(0.005)**
Race-Black	-0.069***	-0.052***	-0.101***
	(0.008)	(0.008)	(0.015)
Race-Other	-0.037***	-0.054***	-0.071***
	(0.013)	(0.014)	(0.025)
Single	-0.140***	-0.136***	-0.158***
	(0.006)	(0.006)	(0.010)
Educated	0.096***	0.093***	0.114***
	(0.002)	(0.002)	(0.004)
Age	0.015***	0.012***	0.037***
	(0.001)	(0.001)	(0.002)
Age squared	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)
Home Renter	0.089**	0.084***	0.123**
	(0.033)	(0.028)	(0.054)
Not working	-0.076***	-0.082***	-0.065***
	(0.008)	(0.008)	(0.014)
Family size	0.063***	0.070***	0.057***
	(0.002)	(0.002)	(0.003)
Area 1	-0.025***	0.020***	-0.110***
	(0.007)	(0.007)	(0.012)
Area 2	-0.070***	-0.009	-0.165***
	(0.006)	(0.006)	(0.010)
Area 3	-0.069***	-0.015**	-0.183***
	(0.006)	(0.006)	(0.011)
Year 1989	-0.127***	-0.153***	-0.124***
	(0.008)	(0.008)	(0.016)
Year 1992	-0.078***	-0.095***	-0.062***
	(0.007)	(0.007)	(0.014)
Year 1995	-0.022***	-0.054***	0.013
	(0.008)	(0.007)	(0.014)
Year 1998	-0.056***	-0.092***	-0.037***
	(0.007)	(0.007)	(0.013)
Year 2001	0.047***	0.034***	0.074***
	(0.006)	(0.006)	(0.011)
Old* Net Fin. Assets	-0.001	-0.004***	0.005*
	(0.001)	(0.001)	(0.002)
Old*Other real estate	0.008***	0.003	0.007
	(0.003)	(0.003)	(0.004)
Old*House	0.001	0.016***	-0.036***
	(0.002)	(0.002)	(0.003)
Old*Income	-0.004	-0.017***	0.038***
	(0.002)	(0.003)	(0.004)
Constant	5.331***	4.897***	3.210***
	(0.059)	(0.052)	(0.109)
Obs.	58580	58580	58580
R-squared	0.64	0.66	0.42

THE RESPONSE OF PRIVATE CONSUMPTION TO DIFFERENT PUBLIC SPENDING CATEGORIES: VAR EVIDENCE FROM UK

Luigi Marattin[±] Simone Salotti[÷]

Abstract

This paper performs a Structural VAR analysis on UK economy using quarterly non-interpolated data from 1981 to 2005 in the attempt to verify and quantify private consumption's response to different components of public expenditure (government consumption, social spending and wage component). Our findings suggest that any empirical support of competing theoretical models on the issue would probably benefit from a disaggregation of government expenditure, rather than focusing on the aggregate measure. In fact, while shocks to pure government consumption trigger a RBC-like reduction in private consumption, shocks to the non-systematic component of social spending generate positive reaction, in line with the "credit-constrained-agents" approach. The cumulative impact on consumption after three years of a government spending shock is twice as much the social spending shock, with opposite sign. Government wage shocks do not seem to have any significant effects on private consumption. Public expenditure composition, rather than level, seems to be actually playing the most crucial role when it comes to aggregate demand support via effects on private consumption.

JEL: E62, H30.

Keywords: Fiscal Policy, Government Expenditure, VAR Analysis.

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1. Introduction

The severity of the last economic downturn following the global financial crisis has intensified the search for the typology of public expenditure able to maximize the short-term impact on economic activity. As recovery plans' specifications differ across countries, the very basic question remained the same: which fiscal policy weapon is associated with the highest multiplier? The attempt to evaluate the fiscal policy's effectiveness has often resulted on the sign and magnitude of (actual or cyclically-adjusted) budget deficit's impact on GDP. Perotti (2007) provides a good review on the comparison between different theoretical models and their empirical predictions regarding the impact on income. In this paper, we investigate a slightly different question: how do different categories of public expenditure affect private consumption? The relevance of the issue rests on private consumption's major weight among aggregate demand's components, as showed by Figure 1. This in turn is the reason why consumption's response to economic stimulus plans is the key determinant of output multipliers.

In order to answer this question, we perform a structural VAR analysis on the UK economy, using quarterly non-interpolated data from 1981 to 2005. In line with some recent studies (Beetsma et al. 2006, Beetsma 2008, Giordano et al. 2007, Cavallo 2005 and 2007, Monacelli and Perotti 2008) we do not focus on public finance aggregates but rather on budget deficit's single components. Our disaggregation is mainly on the expenditure side, as we are primarily concerned with the aggregate consumption effects of different public expenditure categories. Unlike many of the above-mentioned contributions, we do not limit ourselves to the identification of wage and non-wage components of public expenditure, but rather distinguish among government consumption, government wage expenditure and social spending.

Our results, robust to a number of alternative specifications, show that the only component resulting in a positive and significant response of private consumption is social expenditure, defined as the sum of social security benefits and subsidies, net of social security contributions. On the other hand, government consumption seems to have a negative and significant effect, whereas wage expenditure has no impact. Regarding the magnitude of those effects, in our benchmark model the cumulative impact on private consumption of a government spending shock equal to 1% of GDP is in absolute terms higher than the one (of the same magnitude) to the social expenditure component: while shocks to the former lead to a -0.9% impact on GDP, shocks to the latter cause a +0.5% cumulative response. A consequence of our analysis is that using total government expenditure (by aggregating the three components above) does not seem to be a reasonable simplification: in fact, when these three components of government expenditure enter the VAR in a unique aggregate measure, the result is a zero-impact on private consumption (see section 4), as also found by Perotti

(2004).[1] Instead, disaggregating public expenditure conveys more detailed and differentiated information on its actual capabilities to affect private consumption. This result is particularly noteworthy as the empirical literature on UK economy has so far achieved mixed conclusions regarding the response of private consumption to government spending shocks (Perotti 2004, 2007, Monacelli and Perotti 2006), while we provide sufficiently robust evidence via our proposed disaggregation.

We also believe these results to be relevant for the theoretical debate between alternative and competing approaches modelling private consumption's impact of fiscal shocks. As it is well known, the standard neoclassical RBC model predicts a fall in consumption following a government expenditure shock, because of the Ricardian equivalence: higher public spending must be matched by an equivalent increase in taxation in present discounted terms, therefore intertemporal optimizing consumers suffer from a negative wealth effect that decreases consumption. Effects on output are positive due to increased labour supply, triggered by the wealth effect. Since virtually no study seems to confirm the prediction of the standard neoclassical model (as pointed out by Galì, Lopez-Salido and Valles 2007), New Keynesian tradition attempted to reconcile theory with empirical evidence and rescued a consumption-enhancing role for fiscal policy. This has been accomplished either using finite-horizons frameworks (Blanchard 1985) or introducing credit-constrained agents and rule-of-thumb consumers (Mankiw, 2000, Galì et al 2004, 2007).[2] This latter approach has particularly gained considerable attention. It includes a fraction of non-Ricardian households who do not optimize over the life cycle and are thus forced to consume out of current income, so that their consumption responds promptly to a fiscal policy impulse.[3] A further research strand explicitly considers the *per se* government expenditure's impact on consumption. This is often carried out by an ad-hoc utility function specification where private and public consumption are entered in a non-additive form, so to obtain a non-zero impact of one on the marginal utility of the other (Bouakez and Rebei 2003); on the other hand, there is a large non-VAR empirical literature attempting to assess the sign and the magnitude of the relationship (Aschauer 1985, Campbell and Mankiw 1990, Graham and Himarios 1991, Graham 1993, Karras 1994, Ni 1995, Amano and Wirjanto 1998, Okubo 2003, Fiorito and Kollintzas 2004) which however led to mixed and inconclusive evidence.

The present study can be relevant for all the above-mentioned theoretical discussions. We provide

[1] Perotti finds a non-significant effect of fiscal shocks on consumption for the period 1980-2000. We confirm this finding, with an aggregate measure of consumption, over a 1981 – 2005 sample.

[2] As a matter of fact, there is also a third way to the same result. Ravn et al. (2004) obtain a positive effect on consumption without credit-constrained agents, but assuming that the representative individual forms consumption habits on the individual variety in a monopolistic competition setting, rather than on aggregate consumption.

[3] As discussed by Galì, Lopez-Salido and Valles (2007), the presence of non-Ricardian consumers must be coupled with sticky prices and imperfectly competitive markets in order to obtain a private consumption's positive response.

evidence that – at least in our case study – considering the indistinct aggregate of government expenditure can indeed be very misleading. The identification of social expenditure as the only government expenditure category which is effective in stimulating private consumption leads to two remarks: (i) the complementarity/substitutability issue cannot be discussed independently from a sufficient disaggregation of government expenditure (ii) the rule-of thumb-consumers approach can indeed be justified no longer on the assumption of an exogenous fraction of credit constrained agents, but on the existence of a precise portion of public expenditure that stimulates a fraction of consumers, specifically those who are the beneficial of social expenditure (presumably the lower part of income distribution), and who consume out of it.

The remainder of this paper is organized as follows. Section 2 presents the benchmark model, the data and discusses the identification procedure. Section 3 contains the estimation results (impulse response analysis and variance decomposition) with particular regard to the reaction of private consumption to different kinds of government expenditure shocks. Section 4 deals with robustness and sensitivity analysis, by estimating several different variations of the benchmark VAR model. Section 5 concludes and discusses policy implications.

2. Variables and model specification

The benchmark specification of our model is a seven-variables VAR, whose reduced form is defined by the following dynamic equation:

$$Y_t = c + A(L)Y_{t-1} + U_t \qquad (1)$$

where $Y_t = \left[C_t, T_t, P_t, GC_t, GSS_t, GW_t, B_t\right]$ is the vector of variables composed by private consumption (C_t), net government taxes (T_t), consumer price index (P_t), government consumption (GC_t), government outlays in social security (GSS_t), government wage expenditure (GW_t) and government financial liabilities (B_t). The variables are all integrated of order 1. $A(L)$ is an auto regressive lag polynomial, and U_t is the vector of reduced-form innovations. The VAR also includes a constant (c) and a linear time trend, although we omit the latter from the notation for convenience. We chose not to include public investment into the analysis as this component implies external effects (such as production externalities) that are not immediately associated with private consumption, which is the focus of this paper. We also do not explicitly consider tax shocks, as they

are particularly hard to identify in a SVAR model.[4]

"The availability of quarterly fiscal variables represents the main constraint for the analysis of fiscal policy with VAR models" (Giordano et al. 2008, p. 6). Furthermore, Perotti (2004) correctly warns against the distortions coming from the usage of quarterly data set obtained by interpolation of yearly values. This remark makes the data availability constraint even more binding, and poses considerable limitations to the implementation of a fully-equipped large scale time series analysis. We have chosen to sacrifice the generality of our conclusions in favour of a complete non-interpolated quarterly data set; this paper focuses on United Kingdom, and uses data from 1981Q1 to 2005Q4.[5]

The source for almost all of the variables that we used is the OECD Economic Outlook No 83.[6] The benchmark specification includes: the log of real private final consumption expenditure per capita *C*, the log of real taxes per capita *T* (defined as the sum of direct and indirect taxes, other receipts and property income received by government), the harmonized consumer price index *P*,[7] the log of real government consumption per capita *GC* (defined as the sum of government final non-wage expenditure and other current outlays), the log of real government social expenditure per capita *GSS* (defined as the sum of net social security benefits and subsidies), the log of real government final wage expenditure per capita *GW*, the log of real government financial liabilities per capita *B*. Additional variables used for robustness checks include the log of real GDP per capita, the short term interest rate on government bonds, and the sum of the three components of government expenditure, *GTOT*. All real variables are deflated by the GDP deflator. Population data come from the World Development Indicators of the World Bank.

We estimate the seven equations of system (1) independently using least squares. The number of lags is set to five according to the Akaike Information Criterion and the absence of serial correlation in the residuals, positively checked with a Lagrange Multiplier test.[8] Moreover, we failed to reject the hypothesis of normality of residuals with the Jarque-Bera statistics and we checked the stability condition of the VAR, finding that all eigenvalues comfortably lie inside the unit circle. We also tested for the presence of cointegrating relationships among the variables, finding mixed evidence according to the rank and the maximum eigenvalue tests. Due to that, and given that our a priori did not include a meaningful long-run relationship among the variables, we decided not to impose any

[4] In both cases we follow Perotti (2007).

[5] This period has been chosen because of the strong evidence that points towards a structural break between 1981 and the previous period (Perotti, 2004).

[6] The quarterly data of the Economic Outlook are normally obtained by interpolation, but not those of the UK.

[7] Here the source is UK National Statistics.

[8] The chi-square statistics for autocorrelation up to first and second order and 2 are 54.0872 and 33.7088 which imply p-values, respectively, of 0.2863 and 0.9528. Different criteria for lag length selection (final prediction error, AIC, SIC) led to a number of lags smaller than three, but dealing with quarterly data on fiscal policy we decided to disregard these options as we preferred to include at least one year of observations.

cointegrating restriction and, thus, estimate the VAR with the variables in levels (Sims et al. 1990, Giordano et al. 2008).

We turn now to the identification issue. The literature on fiscal policy VARs has traditionally adopted two alternative strategies in order to identify exogenous and unexpected fiscal shocks (Beetsma, 2008). The first one identifies deviations of fiscal policy from its systematic path by using dummy variables so to capture specific episodes that can reasonably be interpreted as exogenous and unforeseen (Ramsey and Shapiro 1999, Burnside et al 2004, Romer and Romer 2007, Monacelli and Perotti 2008). Such a strategy has the advantage of being simple and straightforward, as it is relatively easy to justify and does not require any additional assumption; on the other hand, it might lack the appropriate accuracy, since the resulting impulse response functions might be affected by the delayed effects of previous events who are not captured by the contemporaneous effect of the dummy. The second strategy – more widespread - imposes alternative types of structural restrictions: they can be sign restrictions on the impulse response functions (Uhlig 2005, Mountford and Uhlig 2005, Canova and Pappa 2007,Enders *et al* 2008), external and institutional information exploiting the quarterly nature of data and fiscal policy decision lags (Blanchard and Perotti 2002, Perotti 2004, Muller 2008, Monacelli and Perotti 2008), or restrictions on contemporaneous relations among variables and error terms in the structural form (Marcellino 2006, Beetsma *et al* 2006, Beetsma 2008, Benetrix and Lane 2009).

Our identification strategy is the latter. In particular, we adopt a Cholesky factorization so to recover the vector of structural shocks ε_t (and its variance Ω) from the reduced-form error U_t in (1), according to the following scheme:

$$\begin{bmatrix} \varepsilon_t^{C} \\ \varepsilon_t^{T} \\ \varepsilon_t^{P} \\ \varepsilon_t^{GC} \\ \varepsilon_t^{GSS} \\ \varepsilon_t^{GW} \\ \varepsilon_t^{B} \end{bmatrix} = \begin{pmatrix} 1 & \alpha_T{}^{C} & \alpha_P{}^{C} & \alpha_{GC}{}^{C} & \alpha_{GSS}{}^{C} & \alpha_{GW}{}^{C} & \alpha_B{}^{C} \\ 0 & 1 & \alpha_P{}^{T} & \alpha_{GC}{}^{T} & \alpha_{GSS}{}^{T} & \alpha_{GW}{}^{T} & \alpha_B{}^{T} \\ 0 & 0 & 1 & \alpha_{GC}{}^{P} & \alpha_{GSS}{}^{P} & \alpha_{GW}{}^{P} & \alpha_B{}^{P} \\ 0 & 0 & 0 & 1 & \alpha_{GSS}{}^{GC} & \alpha_{GW}{}^{GC} & \alpha_B{}^{GC} \\ 0 & 0 & 0 & 0 & 1 & \alpha_{GW}{}^{SS} & \alpha_B{}^{GSS} \\ 0 & 0 & 0 & 0 & 0 & 1 & \alpha_B{}^{GW} \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 \end{pmatrix} \begin{bmatrix} u_t^{C} \\ u_t^{T} \\ u_t^{P} \\ u_t^{GC} \\ u_t^{GSS} \\ u_t^{GW} \\ u_t^{B} \end{bmatrix} \qquad (2)$$

The Cholesky ordering as in (2) is equivalent to assuming the following set of conditions. Consumption is the most endogenous variable and it is therefore affected by all contemporaneous values of all the variables of the VAR; this is natural, as the present study is primarily concerned

with the analysis of macroeconomic effects on private consumption. Tax revenue is allowed to depend on prices and all fiscal variables, assuming that the government operates under a balanced budget-like stance[9]. Nominal rigidities in the form of delayed price adjustments justify the fact that the general price index is not affected by demand conditions within the quarter. Fiscal variables are modelled as the most exogenous ones, starting from the real stock of government liabilities, which can legitimately be considered as given in a quarterly data set; government wage expenditure is assumed to be the most rigid among spending categories, as its dynamics are usually governed by collective contracts whose length is well beyond the quarter. Social expenditure and government purchases of goods and services are thought to be featured by lower degrees of exogeneity in the ordering. Note that all government expenditure categories are allowed to depend on debt. Although our scheme can be arguable (as it is often the case in a Cholesky ordering), we believe that the data frequency grants us a sufficient degree of flexibility in the choice; we also provide a number of robustness checks in section 5 so to strengthen the general validity of our benchmark estimation.

3. Estimation results

3.1 Impulse response analysis

Figures 2a-c display the results of our baseline model. Each figure displays the response of all the 7 variables of the model to each one of the three government spending variables shocks equal to 1 percent of GDP (Figures 2a, 2b and 2c display the responses to shocks in GC, GSS and GW respectively). In order to derive the 16th and 84th percentiles of the impulse-response distribution in the figures, we perform Monte Carlo simulations and assume normality in the parameter distribution. Based on that information, we construct *t*-tests based on 1000 different responses generated by simulations, and check whether the point estimates of the mean impulse-responses are statistically different from zero. The responses of private consumption are expressed as shares of GDP by multiplying the response from the VAR (which is expressed in logs) by the sample average share of private consumption in GDP (as in Monacelli and Perotti, 2006).

Notice, first, that shocks in government consumption and in social spending lead to opposite effects on private consumption: while the first depresses it, as predicted by neoclassical models, the second increases it, as assumed by the credit-constrained approach. Both responses are statistically significant at conventional levels, as shown in Tables 1a-c. Both shocks are very persistent, even though the effects are perceived after three and five quarters in case of, respectively, government consumption and social spending. The former reaches the peak after 9 quarters, with a cumulative

[9] Automatic effects of VAT taxation within the quarter are neglected.

(negative) impact of -0.7% of GDP; the latter after 10 quarters, with a cumulative (positive) impact of 0.4%. It is interesting to note that the cumulative impact after three years of a government spending shock is approximately double the one of social spending, with reversed signs: shocks to government consumption lead to a -0.9% reduction in GDP, whereas shocks to social spending cause a +0.5% cumulative output response. On the other hand, shocks in government wage expenditure have no significant effects on consumption. That result has at least two possible explanations: non-systematic changes in public wages are not perceived as modifications of life cycle income by public employees; or, changes in wage policy in the public sector are not followed by similar increase in the (much wider[10]) private sector, so they fail to trigger a general increase in aggregate wage. It is also worth mentioning the fact that a shock in net taxes seems to affect positively consumption, thereby implying a Ricardian effect of tax-based fiscal consolidation - but the effects are not statistically different from zero at conventional levels. It is important to stress that the benchmark model's results are not sensitive to alternative Cholesky orderings of the government spending variables.

3.2 Variance Decomposition

The variance decomposition analysis is complementary to the impulse response analysis presented above, since it is informative on the relative power of each shock in explaining the forecast error variance of the VAR equations at different forecast horizons. In particular, we look at the contribution of innovations in the three components of government spending to the forecast error variance of the private consumption equation.

Figure 3 shows that, consistently with the impulse response analysis, the proportion of the forecast error variance in the private consumption equation explained by government consumption and social spending is considerably larger than the one explained by the wage expenditure. Moreover, government consumption and social spending have a similar importance in explaining the variance of private consumption (they are both slightly below 20% after 15 periods). Finally, note that the forecast error variance attributable to the 3 components of government expenditure overwhelms even the variance attributable to private consumption itself after 10 periods. This is a confirmation of the importance of the role played by fiscal policy innovations in determining private consumption's dynamics.

[10] In 2005 public sector employment was 20% of all in employment (National Statistics UK)

4. Robustness

In order to check the robustness of our results, we estimated several different VARs to verify whether baseline model's response of private consumption to shocks in the government expenditure variables are confirmed within alternative specifications. Our robustness check proceeds along three steps.

The first one is made of three slight modifications of the baseline model. First we exclude the time trend from the estimation; then we add quarterly dummies, as conventional in the literature (Monacelli and Perotti 2006); finally we include (along with the time trend and seasonal dummies) an additional dummy accounting for Labour party terms in office (specifically, since 1997Q2). The motivation for this test lies in the nature of the relationship this paper investigates: given the non-negligible differences in the stance towards government expenditure by Conservative and Labour governments, we wanted to check whether any differences can be observed in the empirical analysis.

Figures 4, 5 and 6 show, respectively, impulse response functions related to the three above specifications of our first robustness step.

As it can be easily seen, our results are robust – in terms of significance and sign of responses - to these changes to the baseline model (Table 2, 3 and 4 in the Appendix contains the details of the responses).

The second step includes the variation of the VAR dimension and/or variables. Again, the results hold across these different specifications. Figure 7 (with details in Table 5 in the Appendix) shows the results of a 7-variables VAR with the short term interest rate in place of government financial liabilities (this alternative variable is taken into account in various previous studies, such as Marcellino 2006 and Monacelli and Perotti 2007). Figure 8 (and Table 6) displays the result of a 7-variables VAR containing the log of real GDP per capita instead of the price index from the baseline model.

Figure 9,10 and 11 (and Tables 7-9) show the results of three 6-variables VARs resulting from the exclusion of, respectively, financial liabilities, net taxes and the price index. Once more, the negative effects of a government consumption shock and the positive effects of shocks in social spending are well supported by the data. As a final exercise of this second step, we estimate a more parsimonious 5-variables VAR containing consumption, price index and the three components of government expenditure. Results in Figure 12 (and Table 10) are again confirmed.

Our third and final step is maybe the most relevant. We estimate four 5-variables VARs where, compared to the baseline model, each government expenditure category is included separately as the only component; finally, we estimate a specification where we recompose our disaggregation by

including the total aggregate expenditure (*GTOT*) obtained by summing up the three components that we analysed separately so far[11].

Figure 13 presents the impulse response functions of our third robustness step. In particular, we can notice that the effects of total government expenditure shocks on consumption are not significantly different from zero, thereby pointing to a general ineffectiveness of public spending in stimulating private consumption. However, each component has a different quantitative and qualitative impact on consumption, and results are the same as in our benchmark 7-variables model and throughout the robustness checks. A general point can be made about the lagged response of private consumption to *GC* and *GSS,* that we observe in virtually all our estimates: while the (negative) effect of the former is significant pretty soon after the shock, the (positive) effect of social spending becomes statistically significant later (after 5/6 quarters). This result might suggest a tempting interpretation, based on the theoretical debate we base our empirical analysis upon. Since credit-constrained agents consume out of the social expenditure they benefit from, it is plausible to observe a time lag between the moment when the spending decision is approved (when we observe the public expenditure shock), and the moment when the agents' disposable income is actually affected (when private consumption reacts). On the other hand, the quicker (negative) response to government consumption might suggest a RBC-like anticipation effect: the mere approval of an increase in that component triggers a reduction in private consumption, following the negative wealth effect.

5. Conclusions

This paper carried out an empirical analysis on UK economy using quarterly non-interpolated data from 1981 to 2005. Our objective was to verify and quantify the effects of different broad categories of government expenditure on private consumption, so to contribute to the empirical literature which has reported mixed evidence so far. Our findings, robust to a number of alternative specifications of the SVAR, can be summarized as follows. Private consumption seems to respond: i) negatively to government purchases of goods and services; ii) positively on social spending; iii) not significantly to government wage expenditure. While *i)* seems to confirm the standard neoclassical wealth effect, *ii*) strengthens the competing theoretical approach, known as the "credit-constrained" agents (who, in our interpretation, can be identified as the individuals social expenditure is targeted to, as it provides them with the resources to consume out of). Quantitative estimates of the responses' magnitude in our benchmark specification lead to an important policy implication: shocks to government consumption have a cumulative impact on GDP after three years – via private consumption - that is twice as much the one of social spending, with opposite signs.

[11] Note that this aggregate variable adds up exactly to government expenditure net of debt service payments.

This suggests that any expansionary effect of social expenditure might be potentially offset by a parallel increase in pure government consumption, with a negative effect on aggregate demand even though a overall increase in aggregate government expenditure has occurred. This result is strengthened by our robustness tests, showing that trying to measure the fiscal multiplier on private consumption by considering the whole government expenditure aggregate – and not its decomposition according to features and goals – can indeed be misleading.

While we believe that this analysis can represent a useful contribution to a more effective management of fiscal policy tools on the expenditure side, the general validity of the findings is certainly limited by the closed-economy one-country investigation. A panel-VAR analysis on EMU countries would permit the use of easily-available annual data, allowing a more complete answer to our original question, would probably be the most rationale next step.

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Figures

Figure 1: Private consumption as percentage of GDP in main industrialized countries

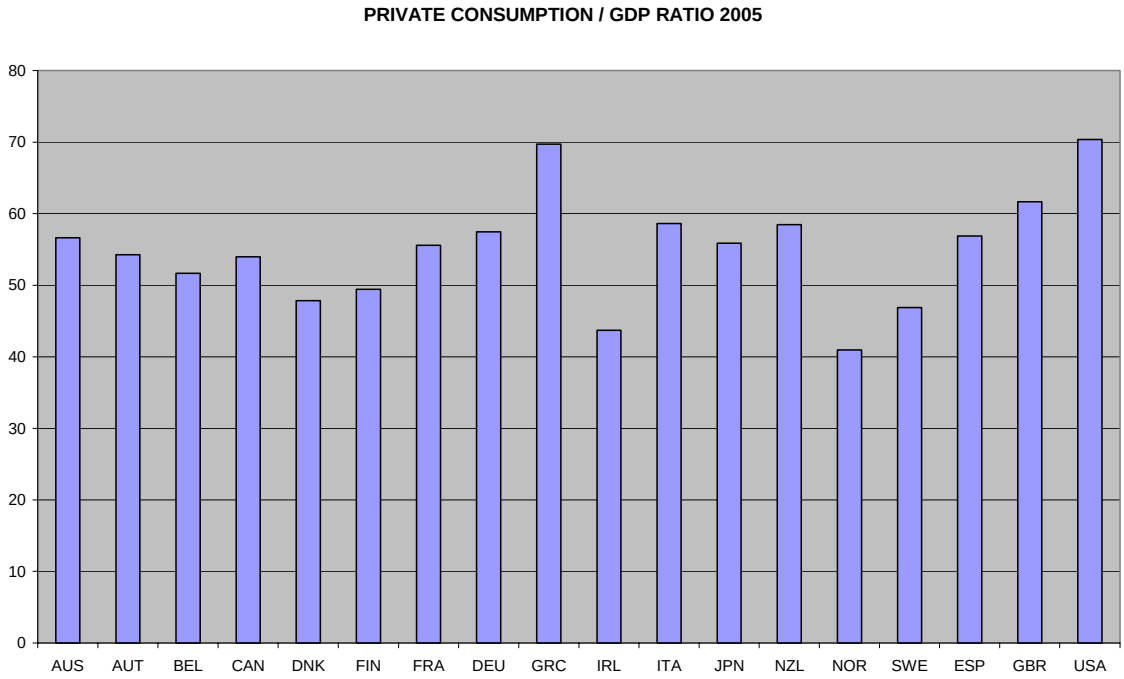


Figure 2a: responses of all variables to a shock of GC

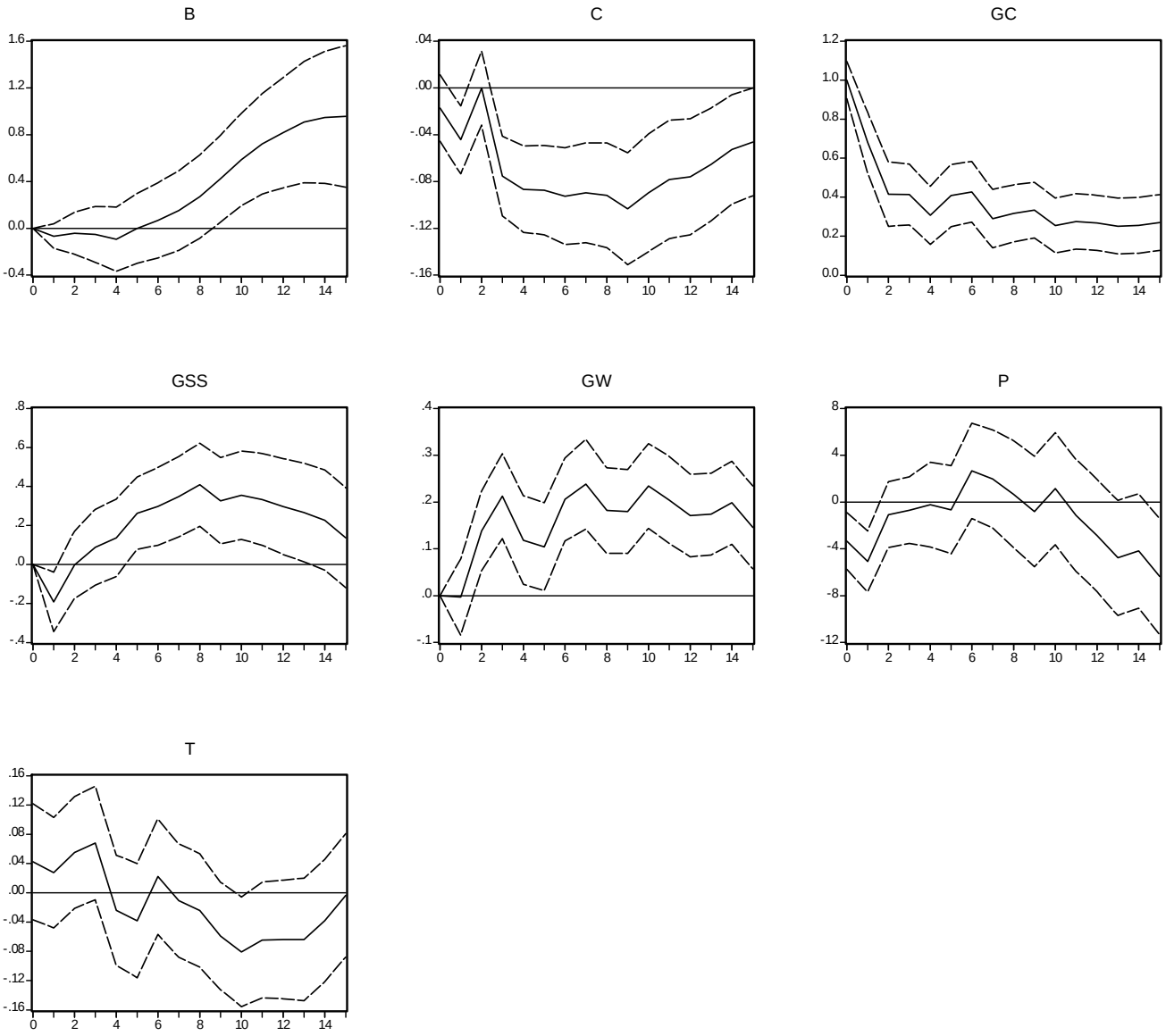


Figure 2b: responses of all variables to a shock of GSS

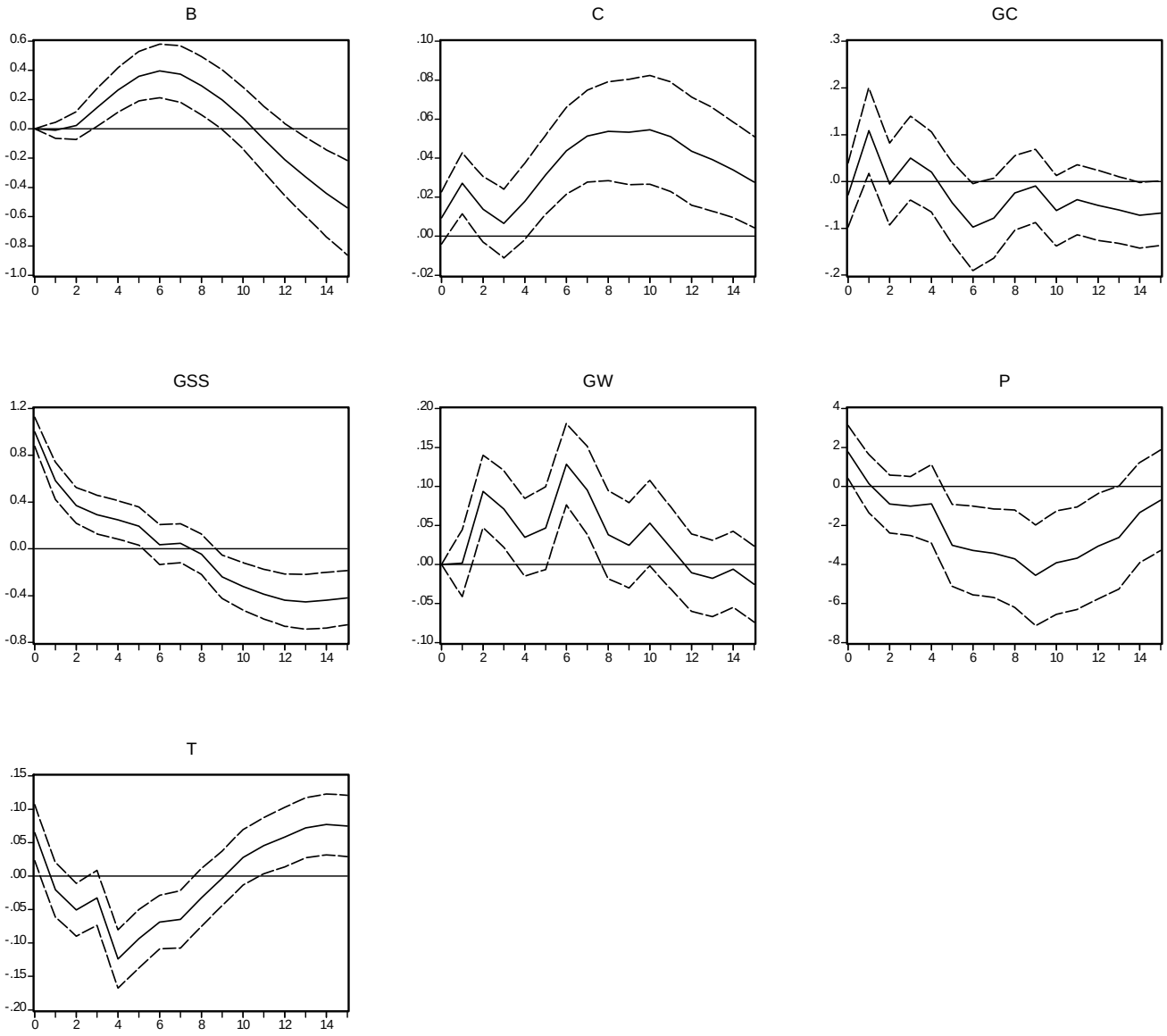


Figure 2c: responses of all variables to a shock of GW

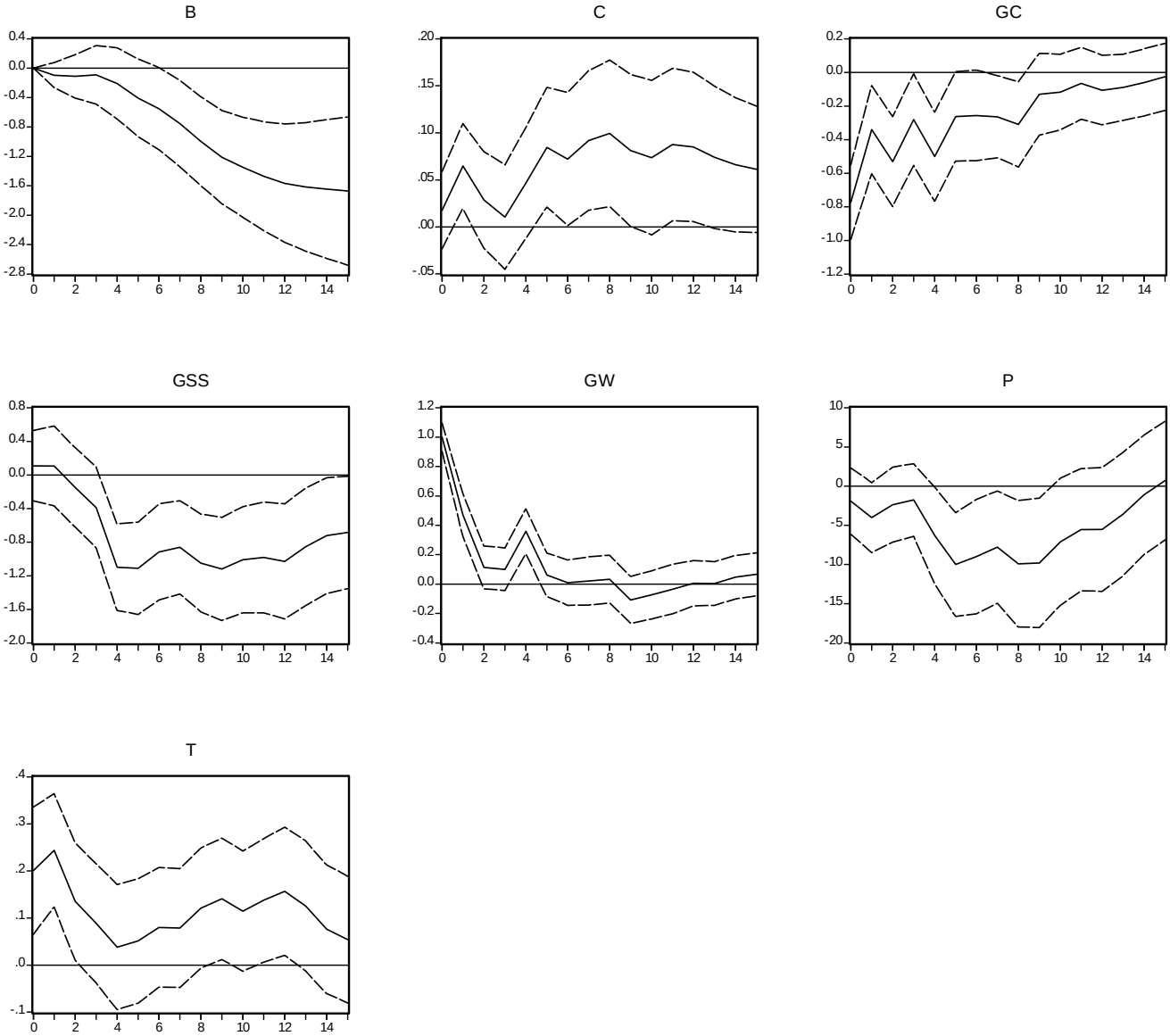


Figure 3: forecast error variance decomposition, private consumption

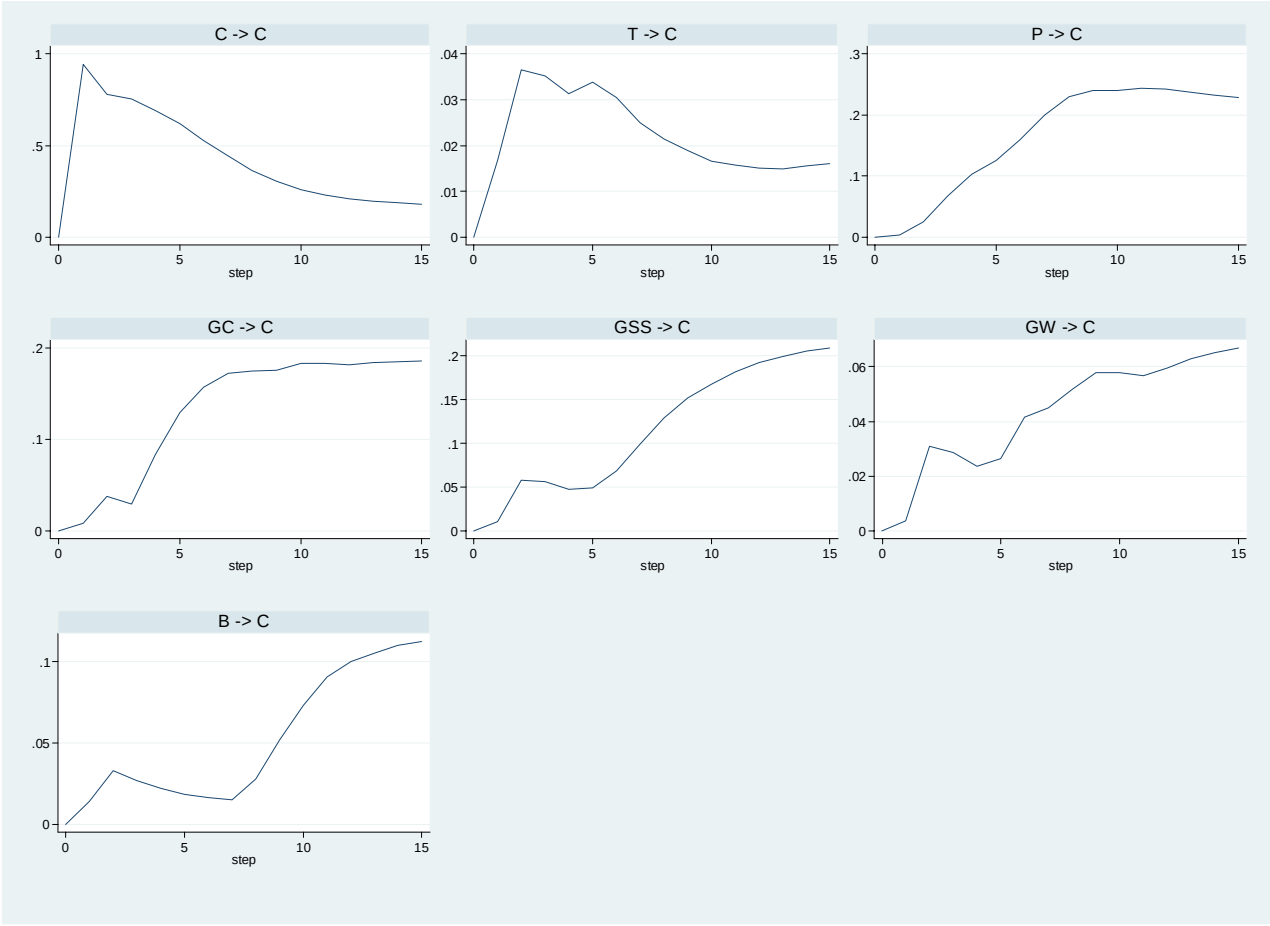
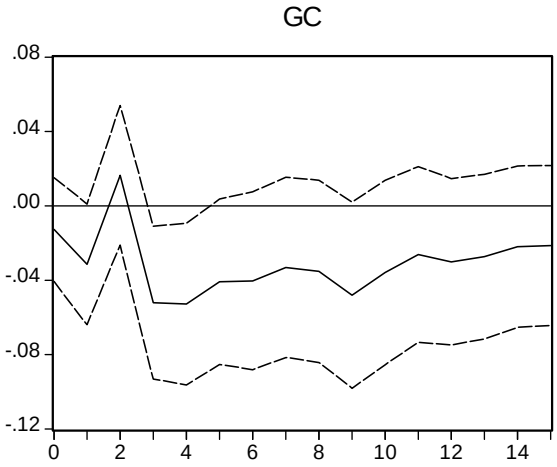
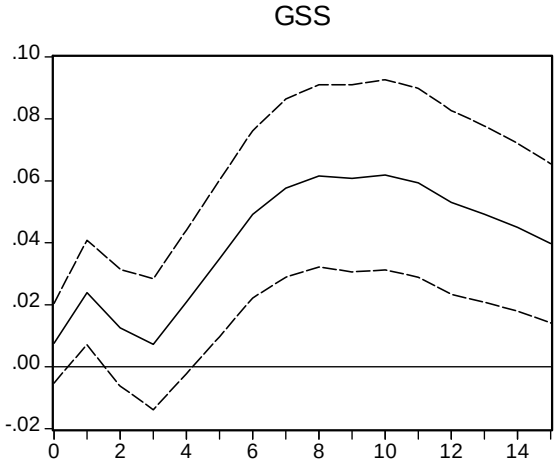


Figure 4: consumption responses, baseline model without the time trend





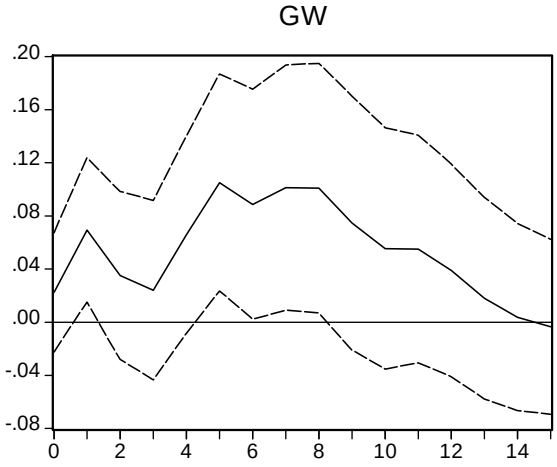


Figure 5: consumption responses, baseline model with quarterly dummies

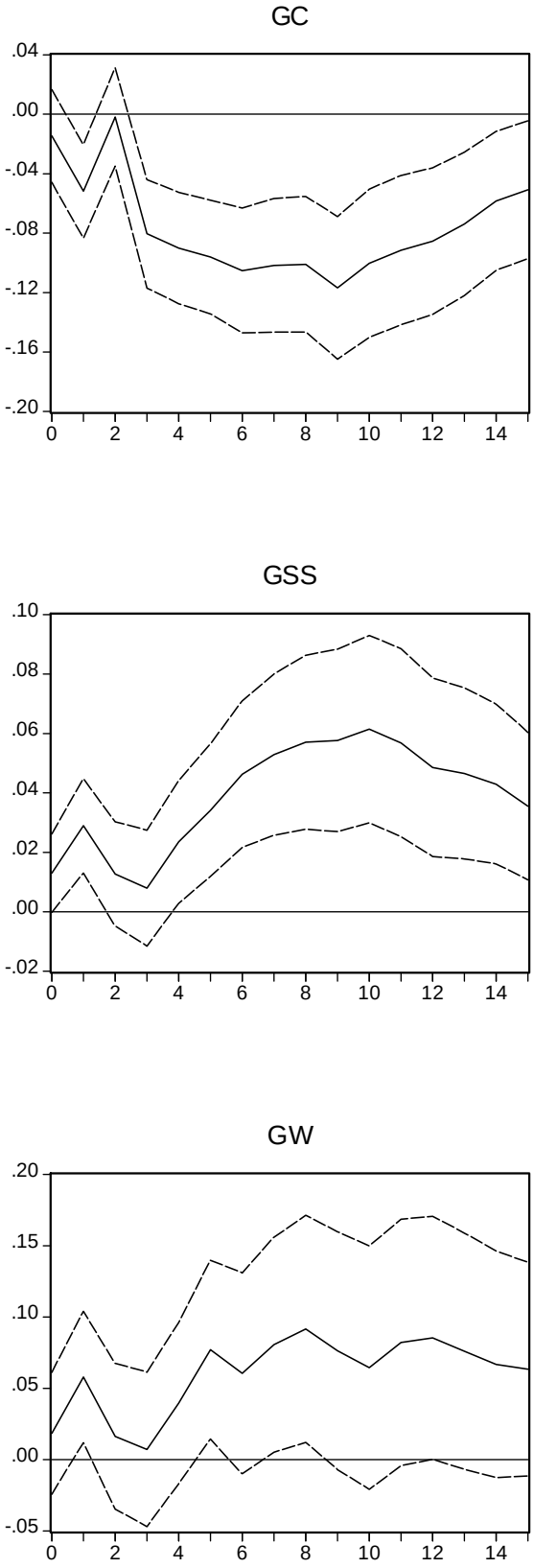
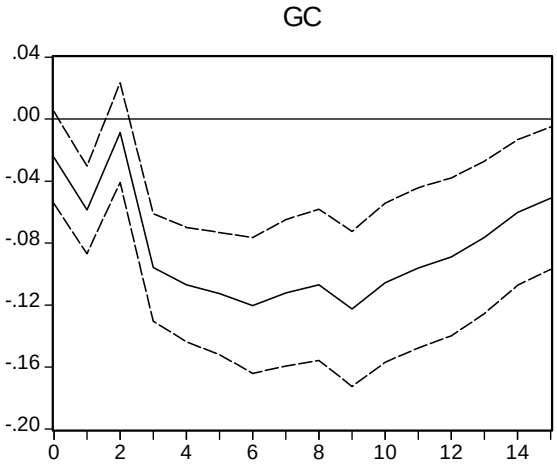
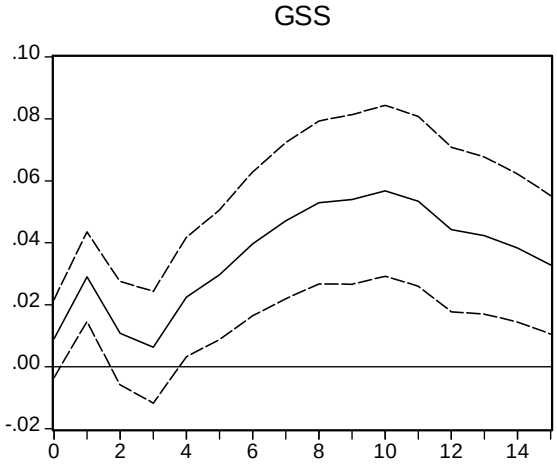


Figure 6: consumption responses, baseline model with quarterly dummies, trend and Labour dummy





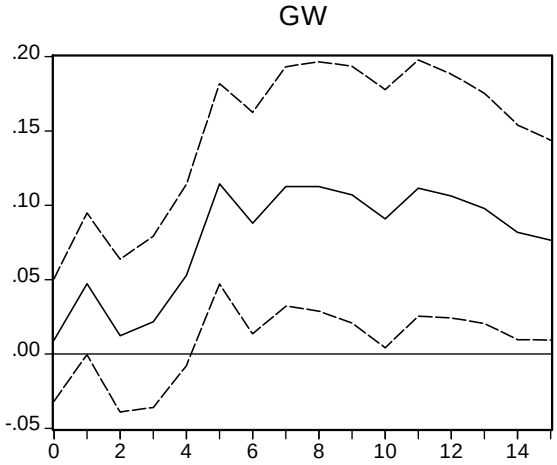


Figure 7: consumption responses, 7-variables VAR with the short term interest rate

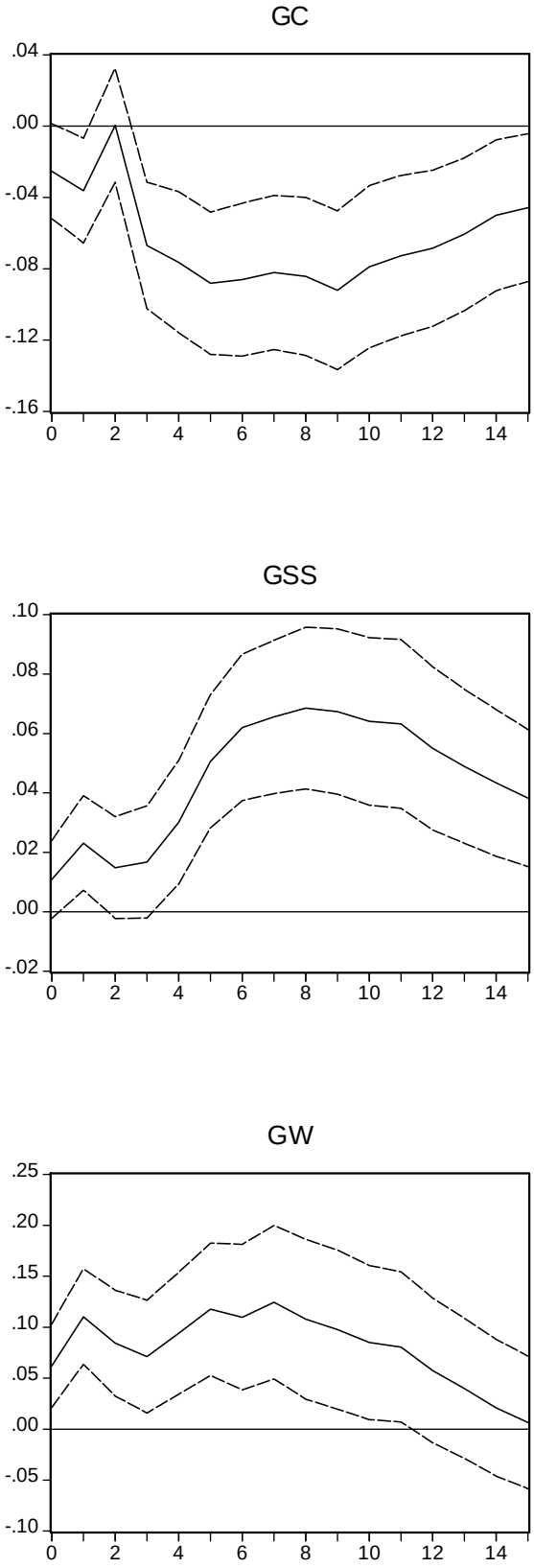
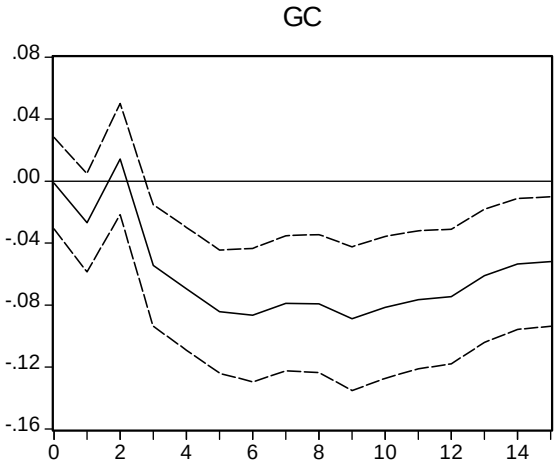
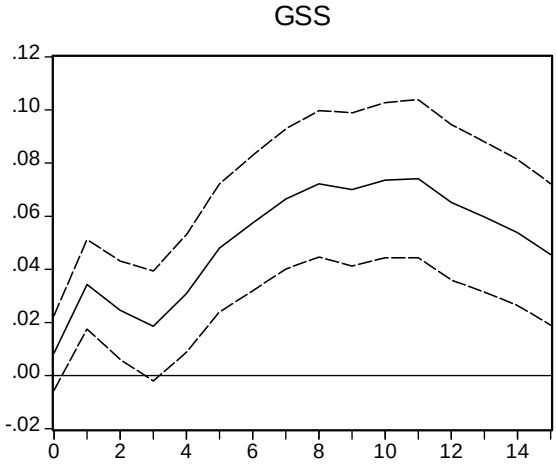


Figure 8: consumption responses, 7-variables VAR with GDP





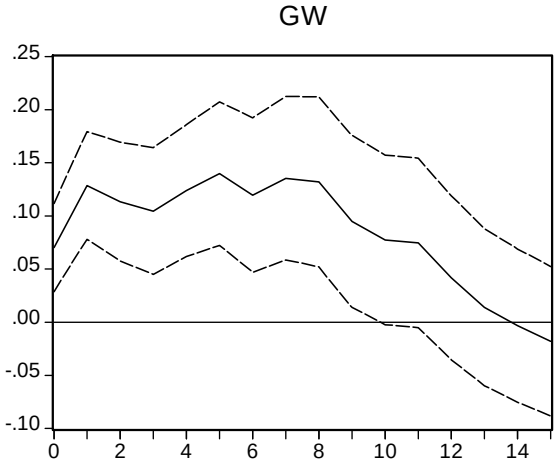


Figure 9: consumption responses, 6-variables VAR (no financial liabilities)

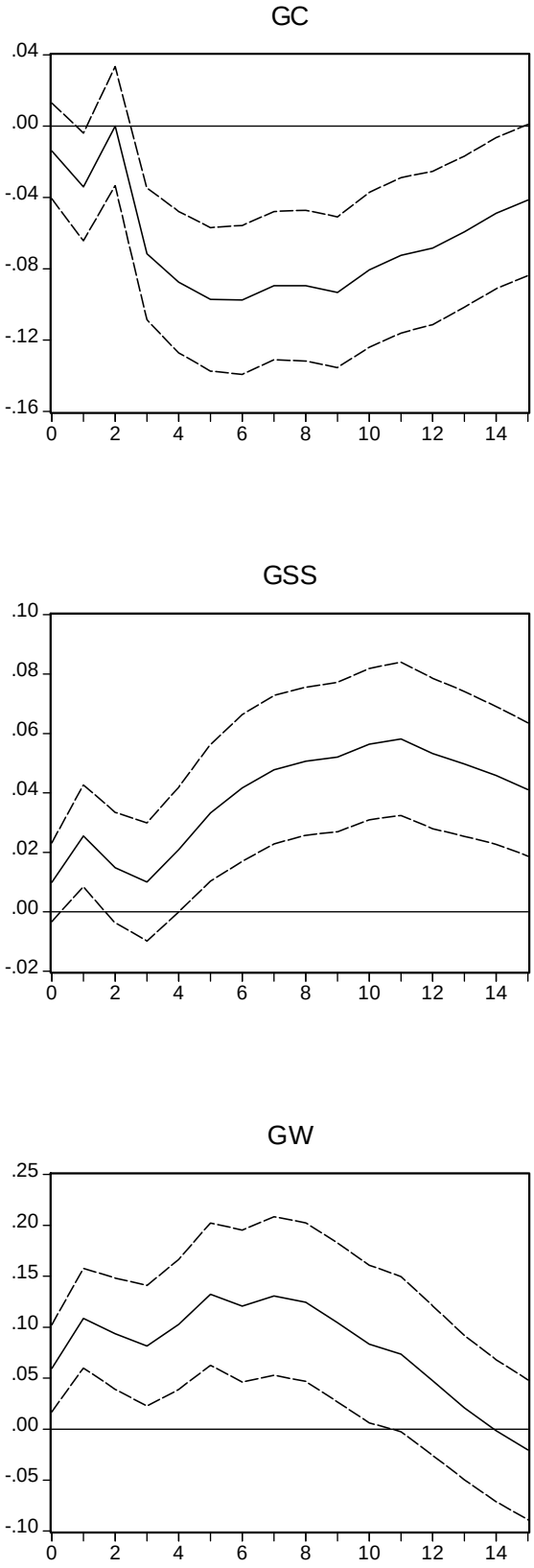


Figure 10: consumption responses, 6-variables VAR (no net taxes)

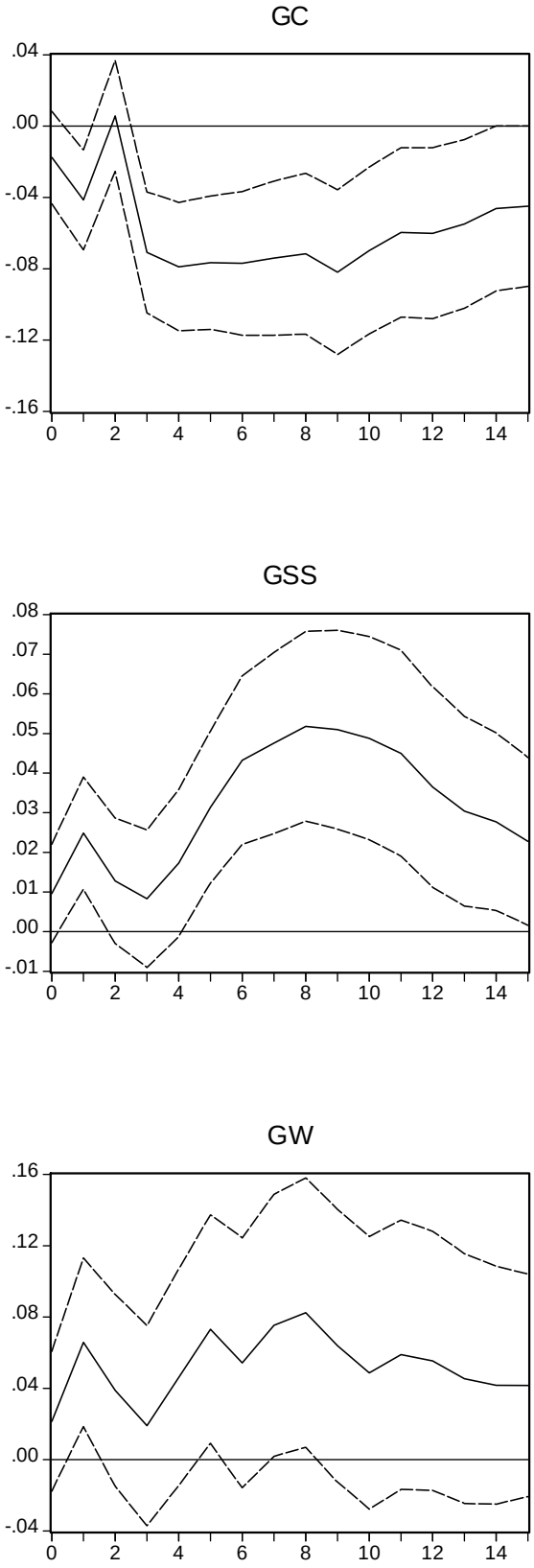
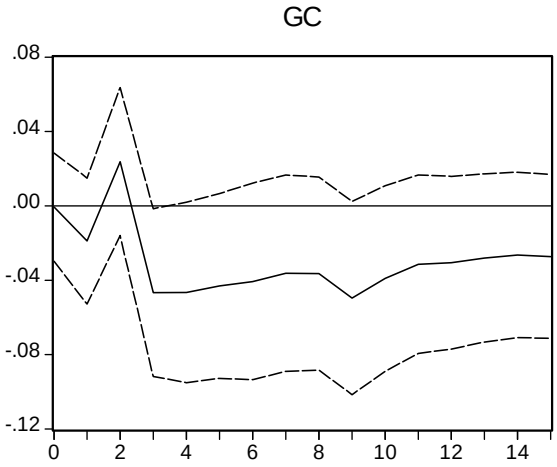
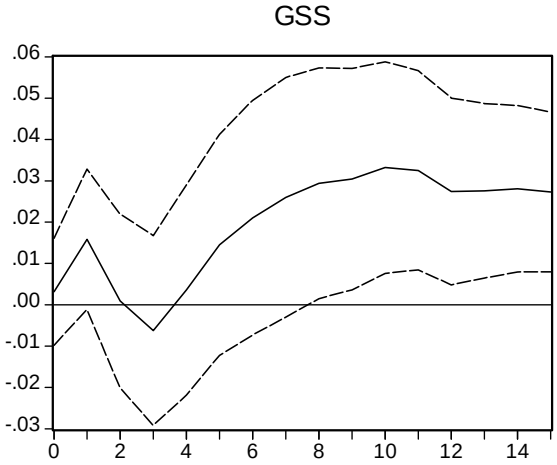


Figure 11: consumption responses, 6-variables VAR (no price index)





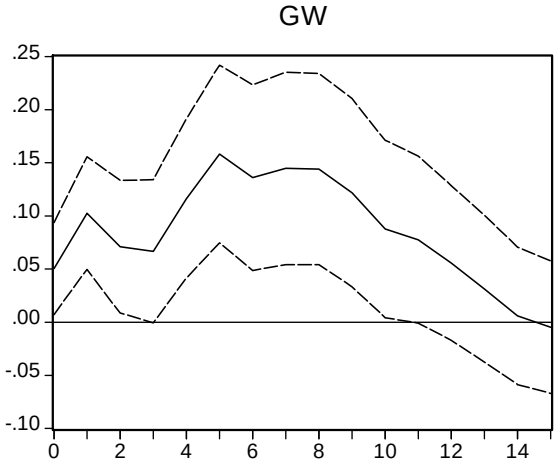


Figure 12: consumption responses, 5-variables VAR (with the three components of government expenditure)

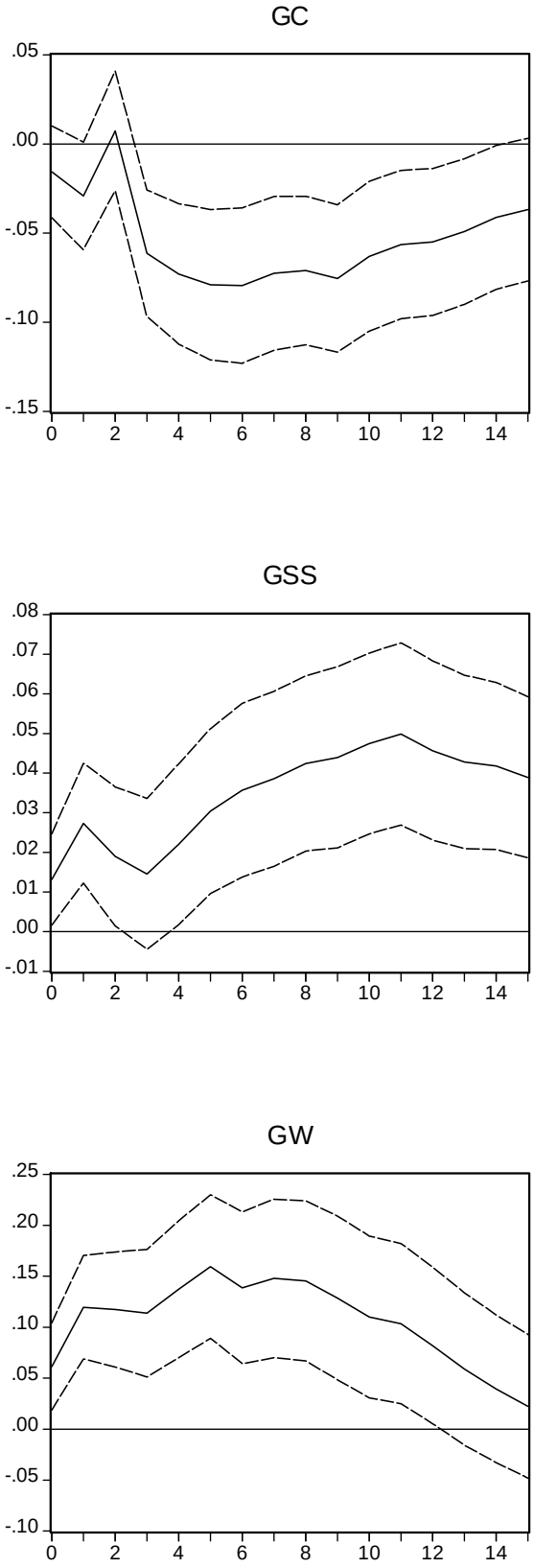
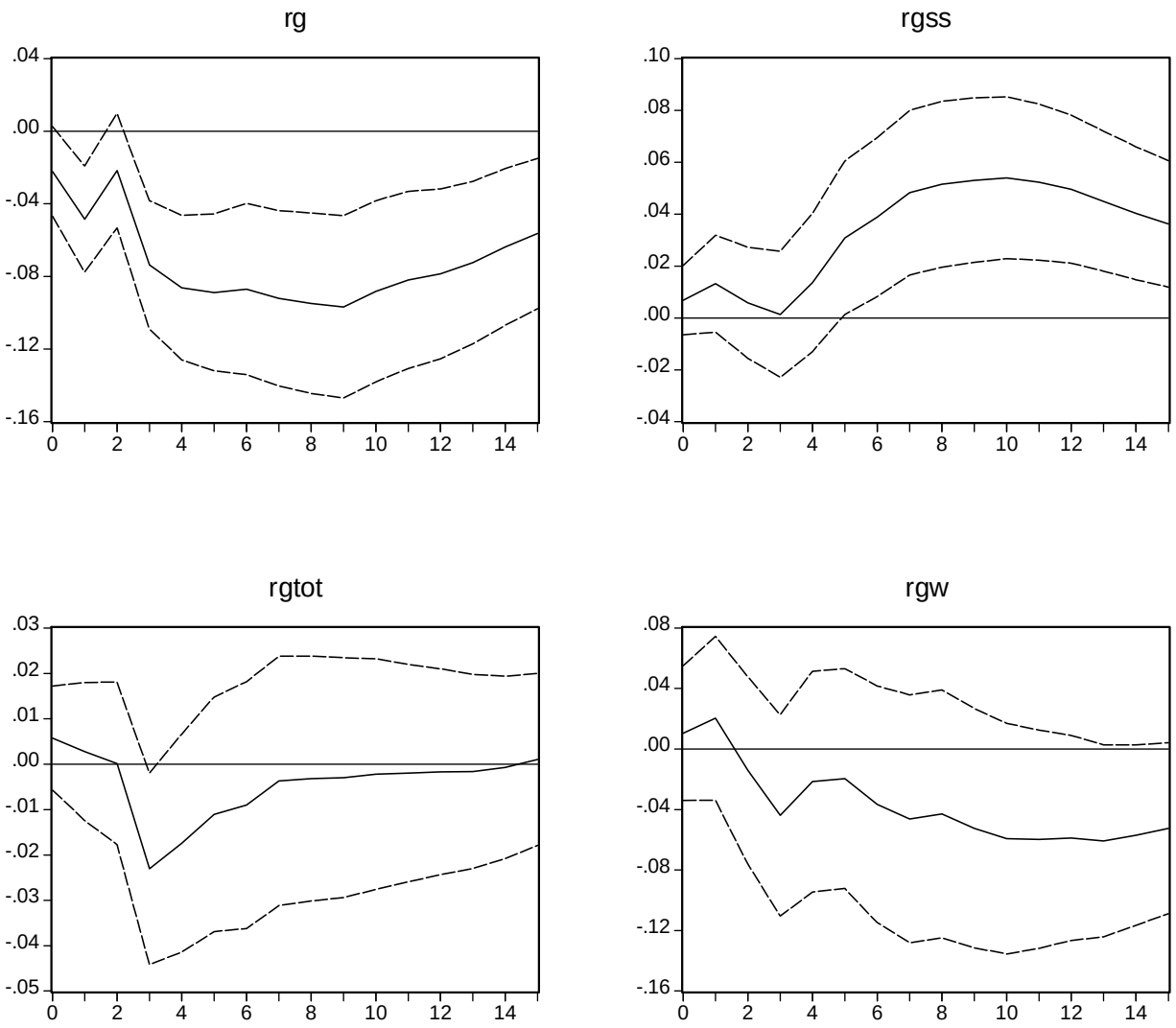


Figure 13: consumption responses, four 5-variables VARs, responses to one government expenditure variable at a time (note: differently from the previous figures, these are the results of 4 different VARs)



Tables

Table 1a: responses of all variables to a shock of GC

	Shock in GC						
response of --->	C	T	P	GC	GSS	GW	B
0	-0.017	0.042	-3.328*	1.000***	0.000	0.000	0.000
1	**-0.044****	0.027	-5.081***	0.680***	-0.307*	-0.003	-0.067
2	0.000	0.055	-1.081	0.415***	-0.003	0.138**	-0.042
3	**-0.075*****	0.068	-0.692	0.414***	0.141	0.213***	-0.052
4	**-0.087*****	-0.024	-0.228	0.306***	0.218	0.119*	-0.093
5	**-0.087*****	-0.038	-0.662	0.408***	0.419**	0.104	0.000
6	**-0.093*****	0.022	2.659	0.427***	0.475**	0.206***	0.068
7	**-0.090*****	-0.011	1.973	0.290***	0.555**	0.238***	0.152
8	**-0.092*****	-0.024	0.650	0.317***	0.651**	0.182***	0.271
9	**-0.103*****	-0.059	-0.815	0.333***	0.521**	0.180***	0.424
10	**-0.090****	-0.081	1.140	0.254**	0.566**	0.234***	0.587
11	**-0.078****	-0.065	-1.139	0.276***	0.531**	0.204***	0.722
12	**-0.076****	-0.064	-2.860	0.268***	0.473*	0.171***	0.817
13	**-0.065***	-0.064	-4.770	0.251***	0.424	0.174***	0.908
14	-0.053	-0.038	-4.176	0.255***	0.362	0.199***	0.947
15	-0.046	-0.004	-6.355*	0.270***	0.218	0.146**	0.956

***, **, *: significant at 1%, 5%, 10%

Table 1b: responses of all variables to a shock of GSS

	Shock in GSS						
response of --->	C	T	P	GC	GSS	GW	B
0	0.009	0.065**	1.767*	-0.029	1.000***	0.000	0.000
1	**0.027****	-0.021	0.139	0.109*	0.582***	0.002	-0.010
2	0.014	-0.051*	-0.900	-0.005	0.371***	0.094***	0.022
3	0.006	-0.033	-1.007	0.050	0.292**	0.071**	0.146
4	0.018	-0.124***	-0.894	0.020	0.247**	0.035	0.266**
5	**0.031****	-0.094***	-3.020**	-0.046	0.195*	0.047	0.360***
6	**0.044*****	-0.069**	-3.282**	-0.097	0.035	0.129***	0.396***
7	**0.051*****	-0.065**	-3.422**	-0.078	0.048	0.095***	0.374***
8	**0.054*****	-0.032	-3.710**	-0.025	-0.045	0.038	0.295**
9	**0.053*****	-0.003	-4.560**	-0.009	-0.240	0.025	0.198
10	**0.055*****	0.028	-3.911**	-0.062	-0.322**	0.053	0.074
11	**0.051****	0.045	-3.683**	-0.039	-0.387**	0.022	-0.071
12	**0.044****	0.058*	-3.066	-0.051	-0.439***	-0.011	-0.210
13	**0.039****	0.072**	-2.617	-0.061	-0.454***	-0.018	-0.328*
14	**0.034***	0.077**	-1.340	-0.072	-0.438***	-0.006	-0.441**
15	**0.028***	0.075**	-0.703	-0.068	-0.418**	-0.025	-0.540**

***, **, *: significant at 1%, 5%, 10%

Table 1c: responses of all variables to a shock of GW

	Shock in GW						
response of --->	C	T	P	GC	GSS	GW	B
0	0.018	0.201**	-1.924	-0.772***	0.109	1.000***	0.000
1	0.065	0.244***	-4.025	-0.341*	0.107	0.470***	-0.096
2	0.029	0.135	-2.367	-0.531***	-0.148	0.113	-0.112
3	0.011	0.089	-1.756	-0.281	-0.388	0.101	-0.091
4	0.047	0.038	-6.273	-0.501***	-1.099***	0.359***	-0.209
5	0.085	0.051	-10.007**	-0.262	-1.113***	0.063	-0.407
6	0.072	0.080	-8.992*	-0.256	-0.918**	0.009	-0.550
7	**0.092***	0.079	-7.785	-0.265	-0.862**	0.021	-0.755*
8	**0.099***	0.121	-9.910*	-0.310	-1.050**	0.034	-0.996**
9	0.081	0.141	-9.799*	-0.131	-1.120**	-0.108	-1.212***
10	0.074	0.115	-7.101	-0.117	-1.010**	-0.074	-1.348***
11	0.088	0.138	-5.558	-0.066	-0.983**	-0.035	-1.470***
12	0.085	0.157	-5.530	-0.106	-1.031**	0.005	-1.566***
13	0.074	0.125	-3.573	-0.089	-0.855*	0.004	-1.617***
14	0.066	0.076	-1.110	-0.060	-0.724	0.047	-1.645**
15	0.061	0.054	0.696	-0.027	-0.685	0.066	-1.672**

***, **, *: significant at 1%, 5%, 10%

Table 2: responses of private consumption, baseline model without the time trend

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.013	0.008	0.022
1	-0.031	**0.024****	**0.069***
2	0.016	0.013	0.035
3	**-0.052***	0.007	0.024
4	**-0.053***	0.021	0.066
5	-0.041	**0.035***	**0.105***
6	-0.040	**0.049****	0.089
7	-0.033	**0.058*****	0.101
8	-0.035	**0.062*****	0.101
9	-0.048	**0.061*****	0.075
10	-0.036	**0.062*****	0.055
11	-0.026	**0.059*****	0.055
12	-0.030	**0.053****	0.039
13	-0.027	**0.049****	0.018
14	-0.022	**0.045****	0.004
15	-0.021	**0.040*****	-0.003

***, **, *: significant at 1%, 5%, 10%

Table 3: responses of private consumption, baseline model with quarterly dummies

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.015	0.013	0.018
1	**-0.052****	**0.029****	**0.058***
2	-0.002	0.013	0.016
3	**-0.081*****	0.008	0.007
4	**-0.090*****	0.024	0.040
5	**-0.096*****	**0.034****	**0.077***
6	**-0.105*****	**0.046*****	0.060
7	**-0.102*****	**0.053*****	0.081
8	**-0.101*****	**0.057*****	0.092
9	**-0.117*****	**0.058*****	0.076
10	**-0.100*****	**0.061*****	0.065
11	**-0.092****	**0.057****	0.082
12	**-0.085****	**0.049****	0.085
13	**-0.074****	**0.047****	0.076
14	**-0.058***	**0.043****	0.067
15	-0.259	**0.036****	0.063

***, **, *: significant at 1%, 5%, 10%

Table 4: responses of private consumption, baseline model with quarterly dummies, trend and Labour dummy

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.025	0.009	0.009
1	**-0.059*****	**0.029*****	0.047
2	-0.009	0.011	0.012
3	**-0.096*****	0.006	0.022
4	**-0.107*****	0.022	0.053
5	**-0.113*****	**0.030****	**0.114****
6	**-0.120*****	**0.040****	**0.088***
7	**-0.112*****	**0.047*****	**0.113****
8	**-0.107*****	**0.053*****	**0.113***
9	**-0.123*****	**0.054*****	**0.107***
10	**-0.106*****	**0.057*****	0.091
11	**-0.096*****	**0.053*****	**0.112***
12	**-0.089****	**0.044****	**0.106***
13	**-0.076****	**0.042****	**0.098***
14	**-0.060***	**0.038****	0.082
15	-0.051	**0.033****	0.076

***, **, *: significant at 1%, 5%, 10%

Table 5: responses of private consumption, 7-variables VAR with the short term interest rate

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.025	0.011	**0.062****
1	**-0.036***	**0.023****	**0.110*****
2	0.000	0.015	**0.084****
3	**-0.067*****	0.017	**0.071***
4	**-0.076*****	**0.030****	**0.094****
5	**-0.088*****	**0.051*****	**0.118****
6	**-0.086*****	**0.062*****	**0.110****
7	**-0.082*****	**0.066*****	**0.124****
8	**-0.084*****	**0.069*****	**0.108***
9	**-0.092*****	**0.067*****	**0.098***
10	**-0.079****	**0.064*****	0.085
11	**-0.073****	**0.063*****	0.081
12	**-0.069****	**0.055*****	0.057
13	**-0.061****	**0.049*****	0.040
14	**-0.050***	**0.043****	0.021
15	-0.046	**0.038****	0.006

***, **, *: significant at 1%, 5%, 10%

Table 6: responses of private consumption, 7-variables VAR with GDP

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.001	0.009	**0.070****
1	-0.027	**0.034*****	**0.129*****
2	0.014	**0.025***	**0.113*****
3	**-0.055****	0.019	**0.105****
4	**-0.070****	**0.031***	**0.124*****
5	**-0.084*****	**0.048*****	**0.140*****
6	**-0.087*****	**0.057*****	**0.120****
7	**-0.079****	**0.066*****	**0.135****
8	**-0.079****	**0.072*****	**0.132****
9	**-0.089*****	**0.070*****	0.095
10	**-0.082****	**0.074*****	0.077
11	**-0.077****	**0.074*****	0.075
12	**-0.075****	**0.065*****	0.042
13	**-0.061****	**0.060****	0.014
14	**-0.054***	**0.054*****	-0.003
15	**-0.052***	**0.046****	-0.018

***, **, *: significant at 1%, 5%, 10%

Table 7: responses of private consumption, 6-variables VAR (no financial liabilities)

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.014	0.010	0.060
1	-0.034	**0.025****	**0.109*****
2	0.000	0.015	**0.094****
3	**-0.072*****	0.010	**0.082***
4	**-0.088*****	0.021	**0.103****
5	**-0.097*****	**0.033****	**0.132*****
6	**-0.097*****	**0.042****	**0.121****
7	**-0.089*****	**0.048*****	**0.131****
8	**-0.090*****	**0.051*****	**0.125****
9	**-0.093*****	**0.052*****	**0.104***
10	**-0.081*****	**0.056*****	0.083
11	**-0.072****	**0.058*****	0.074
12	**-0.068****	**0.053*****	0.048
13	**-0.059****	**0.050*****	0.021
14	-0.049	**0.046*****	-0.002
15	-0.042	**0.041****	-0.020

***, **, *: significant at 1%, 5%, 10%

Table 8: responses of private consumption, 6-variables VAR (no net taxes)

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.018	0.010	0.022
1	**-0.041****	**0.025****	**0.066***
2	0.006	0.013	0.039
3	**-0.071*****	0.008	0.019
4	**-0.079*****	0.017	0.046
5	**-0.077*****	**0.031****	0.073
6	**-0.077*****	**0.043*****	0.054
7	**-0.074*****	**0.048*****	0.075
8	**-0.072****	**0.052*****	0.082
9	**-0.082****	**0.051*****	0.064
10	**-0.070****	**0.049*****	0.049
11	**-0.060****	**0.045****	0.059
12	**-0.060***	**0.036****	0.055
13	-0.055	**0.030***	0.045
14	-0.046	**0.028***	0.042
15	-0.045	0.023	0.042

***, **, *: significant at 1%, 5%, 10%

Table 9: responses of private consumption, 6-variables VAR (no price index)

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.001	0.003	0.050
1	-0.019	0.016	**0.103*** **
2	0.024	0.001	0.071
3	-0.047	-0.006	0.067
4	-0.047	0.004	**0.116** **
5	-0.043	0.014	**0.158*** **
6	-0.041	0.021	**0.136** **
7	-0.036	0.026	**0.145** **
8	-0.037	0.029	**0.144** **
9	-0.050	0.030	**0.122***
10	-0.039	**0.033***	0.088
11	-0.031	**0.033***	0.078
12	-0.031	**0.027***	0.056
13	-0.028	**0.028***	0.031
14	-0.026	**0.028***	0.006
15	-0.027	**0.027***	-0.005

***, **, *: significant at 1%, 5%, 10%

Table 10: responses of private consumption, 5-variables VAR (with the three components of government expenditure)

	Consumption responses		
shock in --->	G	GSS	GW
0	-0.016	0.013	**0.219** **
1	-0.029	**0.027** **	**0.426*** **
2	0.007	0.019	**0.419*** **
3	**-0.061** **	0.015	**0.406*** **
4	**-0.073*** **	0.022	**0.490*** **
5	**-0.079*** **	**0.030** **	**0.569*** **
6	**-0.079** **	**0.036** **	**0.494*** **
7	**-0.073** **	**0.039** **	**0.527*** **
8	**-0.071** **	**0.042*** **	**0.518*** **
9	**-0.075** **	**0.044*** **	**0.459** **
10	**-0.063** **	**0.047*** **	**0.392***
11	**-0.056***	**0.050*** **	**0.369***
12	**-0.055***	**0.046*** **	0.292
13	**-0.049***	**0.043*** **	0.210
14	-0.041	**0.042*** **	0.141
15	-0.037	**0.039*** **	0.080

***, **, *: significant at 1%, 5%, 10%

Table 11: responses of private consumption, four 5-variables VARs with one government expenditure variable at a time (note: differently from the previous tables, these are the results of 4 different VARs)

	Consumption responses			
shock in --->	GTOT	G	GSS	GW
0	0.006	-0.022	0.007	0.011
1	0.003	**-0.048****	0.013	0.020
2	0.000	-0.022	0.006	-0.014
3	-0.023	**-0.074*****	0.001	-0.044
4	-0.017	**-0.086*****	0.014	-0.022
5	-0.011	**-0.089*****	0.031	-0.020
6	-0.009	**-0.087*****	**0.039***	-0.037
7	-0.004	**-0.092*****	**0.048****	-0.046
8	-0.003	**-0.095*****	**0.052****	-0.043
9	-0.003	**-0.097*****	**0.053****	-0.052
10	-0.002	**-0.088****	**0.054****	-0.059
11	-0.002	**-0.082****	**0.052****	-0.060
12	-0.002	**-0.079****	**0.050****	-0.059
13	-0.002	**-0.072****	**0.045****	-0.061
14	-0.001	**-0.064****	**0.040****	-0.057
15	0.001	**-0.056***	**0.036****	-0.052

***, **, *: significant at 1%, 5%, 10%