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How do savings of different agents respond to interest rate change?

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Abstract

The theory underlying the relation between savings and interest rates concerns the household sector, but in modern economies the household sector is not the main source of savings in the economy. Using the SVAR methodology, we try to identify the responsiveness of different sectors' savings to interest rate changes. We focus on Poland and generalize results for other European economies. We found that responsiveness of savings to interest rate is diversified. In most of analyzed countries household savings rise after an interest rate increase, but simultaneously corporate savings fall, indicating negative conditional correlation between households' and corporates' savings. Moreover, the direction of responses of general government and foreign savings are diverse (although the former usually declines after an interest rate increase) and does not seem to be correlated with factors like membership in currency union or the level of debt. We also try to check whether "crowding-out" effects exist and conclude it only applies in the case of government savings crowding out household savings.

Introduction

The theory underlying the relation between savings and interest rates base on household sector as the main source of savings in the economy but in modern economies this is not the case. Sectoral national accounts show that in most of the European countries households are a source of relatively small fraction of total savings (see Figure 1 for year 1999). Household savings usually account less than half of total savings. Moreover, for most of the European countries savings are generated to a large extend by the corporate sector.[1] On the contrary, both general government and ROW savings (calculated as a complement to investment rate) are usually small in relation to GDP. Figure 2 shows that during the next 15 years in most of the European countries household savings declined further (except for Denmark, Ireland and Germany), whereas corporates' savings increased further (except for Finland, Czech Republic and Denmark). Most countries experienced declines of general government savings and increases of foreign savings, too, but to a lesser extent.

The analysis that follows we try to identify the responsiveness of other sectors' savings (mainly corporates) to interest rate changes. Moreover, given heterogeneity of savings responses, we try to assess whether shifts in the structure of savings translate into changes of overall responsiveness of total savings to interest rates. We first focus on Poland – a representative country which experienced a substantial fall in total savings rate, to a large extend driven by a significant fall of household savings with a counteracting rise of corporate savings. Then we try to generalize the results for other European economies. We focus our analysis mainly on households and corporates savings, but we will also discuss the results for other sectors.

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[1] Consistently with subsequent VAR analysis we define corporate sector as both non-financial and financial, with savings concentrated in the former.

We use the SVAR methodology, as it is best suited to answer the question at hand. To identify the model, we utilize the fact that interest rate (apart from being an equilibrating variable for savings and investments), is related to a monetary policy instrument. So, there exist real interest rate shocks not related to savings and investment changes. We filter out those interest rate shocks and investigate the response of different agents' savings to those shocks.

Figure 1 Sources of domestic and savings (domestic and foreign) used to finance domestic investments in selected European countries
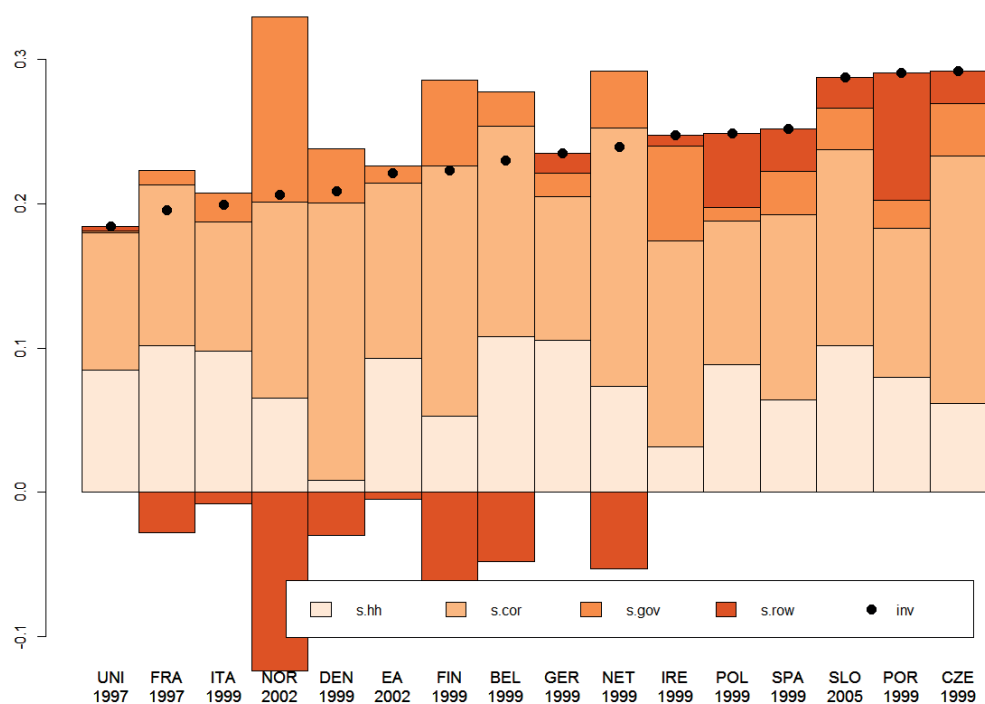

Remarks: All variables expressed in terms of GDP.
Source: Eurostat

We found that responsiveness of savings of various sectors to interest rate changes is diversified among European countries. In most of cases household savings rise after an interest rate increase, but simultaneously, corporate savings fall. So, we

found the negative conditional correlation (conditional on interest rate changes) between household and corporate savings. We also found that direction of responses of general government and foreign savings can be diverse (although the former usually decline after an interest rate increase) and does not seem to be correlated with factors like membership in the currency union or the level of debt.

Figure 2 Changes in savings sources in selected European countries
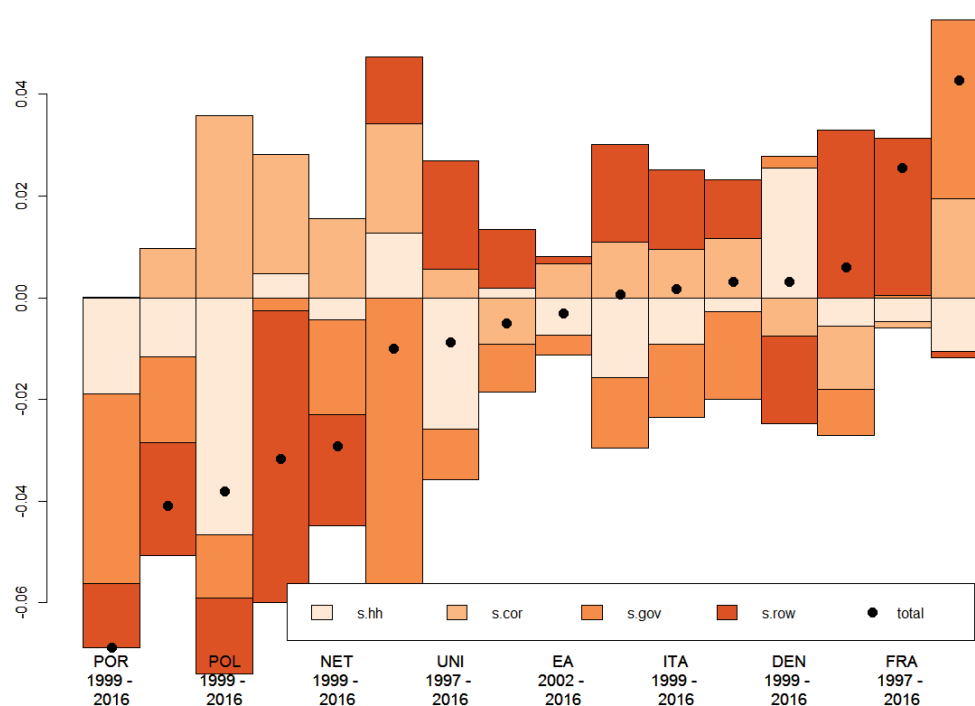
Remarks: All changes expressed in pp. of GDP.
Source: Eurostat

The rest of the paper is organized as follows. Next section reviews literature and discusses the definition of corporate savings. Then, data sources and methodology are presented. We then we focus on the results for our chosen representative country (Poland) to present details of the adjustments taking place. Next, we show the results for the rest of countries in the sample to assess whether the universality of findings. Then, we conclude.

Literature overview

The literature focusing on savings of different agents is rather limited. A recent contribution of (Chen et al., 2017, which extends the previous analysis of those authors in (Karabarbounis and Neiman, 2012)) is especially important for our study. It documents, on a global level, shifts in the composition of savings from households to corporates. It also attaches natural interpretation to the definition of firm savings in the national accounts. Namely, national accounts indicate that gross value added is composed of gross operating surplus (GOS), compensation of labor and net taxes on production. GOS in turn is decomposed into gross savings, net dividends, taxes on profits, interest and other net transfers, corrected for reinvested earning on FDIs. So, as corporate profits is the sum of gross savings and net dividends, it follows that corporate savings can be thought of as retained profits (EBITDA corrected for interest, dividends and corporate taxes). But (Chen et al., 2017) concentrates on longer-term sources of corporate savings increase (focusing on a decline of real interest rate and relative investment goods price, as well as an increase of corporate taxes and profit margins). Our contribution, on the other hand concentrates on short-term aspects of savings shifts, with a focus on the interest rate as an important factor shaping short-term behavior of savings of different agents and diversified responses of those agents to interest rate changes.

This study is naturally related to literature on factors influencing firms' decisions to retained profits. An important aspect of the literature in our context is a relation of interest rates and corporate profits. The two basic channels of this relation are straightforward – first, as interest is a cost, higher interest translates directly into lower profits. Second, as interest rate is an instrument of stabilization policy, so higher interest rate implies lower level of economic activity and lower sales. As some components of total costs (e.g. labor costs) are rigid, in effect corporate profits decline, as documented e.g. in (Knoop, 2015).

But there are other issues that could affect firms' decisions on profits. (Falato et al., 2013) points that the growing role of intangibles, rarely accepted as a collateral in external financing, translates into an increased role of internal financing. (Armenter and Hnatkovska, 2017) stress the fiscal factor and find that demand for net savings is driven by a precautionary motive as firms seek to avoid being financially constrained in future periods. It implies that even with fiscal advantages associated with debt, firms could increase their demand for equity and net savings. Also (Guvenen et al., 2017) point at fiscal optimization in multinationals, but simultaneously stress the role of offshoring – which in case of US causes part of the economic activity (and profits) generated by multinationals to be attributed to foreign affiliates. Those considerations could rather shape long run movements of corporate profits, but could also distort short-run relations and induce heterogeneity of savings behavior between countries.

Finally, the direction of the adjustments of profits to interest rate shocks is also related to cyclicality of profit margins. (Hall, 1986) was one of the first to show procyclicality of markups, translating into higher profits in episodes of lower interest rates. The literature seems to agree on the issue – although papers in the spirit of (Bils, 1987) and (Rotemberg and Woodford, 1999) point into reverse relationship, but (Nekarda and Ramey, 2013) claim that substituting new methods and data into their methodology restores the results of procyclicality of markups.

Methodology and data sources

As the focus of the paper is on short-term volatility and co-movement of interest rates and savings, the SVAR is a natural tool to analyze this phenomenon. We decided (due to relatively short time series) not to analyze explicitly the whole macroeconomic adjustments via GDP and prices, but focus instead only on interest rate and sectoral savings. As a consequence we use VAR (utilizing R package *vars* (Pfaff, 2008)) with 5 variables: real short-term interest rate and savings rates of 4 institutional sectors: households, corporates, government and foreign (rest of the world).

Real interest rate is defined as nominal 3M market interest rate (taken from OECD and Eurostat databases) deflated by current HICP inflation (taken from Eurostat). Savings rates are defined as ratios of gross savings of the corresponding sector and GDP, all expressed in current prices and taken from Eurostat database on quarterly sectoral national accounts. Foreign savings are defined (in line with national accounts standards) as gross capital formation less domestic savings (so, there is implicit information on accumulation in the VAR system) and corporate savings include both financial and non-financial corporates. All data are quarterly (except for monthly data for inflation and interest rates, which were converted to quarterly frequency), seasonality was removed with X-13-ARIMA-SEATS. In most of the 16 countries analyzed[2] the sample range was 1Q1999 – 4Q2016.

The VAR models were estimated with lags chosen automatically with AIC criteria (with max lag fixed at 3). As both the literature and data indicate the presence of long term trends in both interest and saving rates, the stochastic specification was

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[2] Due to data availability, the countries analyzed are: Belgium, Czech Republic, Denmark, Germany, Ireland, Spain, France, Italy, Netherlands, Poland, Portugal, Slovenia, Finland, UK, Norway and EA.

augmented with deterministic trends[3] (and constant). All the estimated VARs were checked for stability (in terms of both characteristic roots being outside unity and in terms of stability of the residuals), autocorrelation, heteroscedasticity and normality. In case of some countries additional dummy variables were introduced, either to enhance econometric properties of VAR, or to address outliers and breaks in data.

The interest rate shocks in the VAR were identified with recursive scheme using the following ordering of variables: $\{r, s_{ROW}, s_{COR}, s_{GG}, s_{HH}\}$, without any additional overidentifying long-run restrictions (as we are interested in interest rate shocks, the ordering of savings is irrelevant). We also imposed no long-run restriction on a system. For stable VARs, this identification scheme implies that transitory changes (chocks) to interest rates have no long-run effect on the structure of savings (which could change in the long run, but in a deterministic way). The assumption that interest rate shocks is a first element in recursive ordering of variables in the system, together with the assumption of orthogonality of shocks, implies that interest rate shocks reflect pure price shocks, unrelated to other, non-price changes in the saving and investment schedules. Considering that interest rate is a monetary policy instrument, the changes in monetary policy should be one of, but not the only[4], source of volatility of shocks identified here (but the setup does not identify monetary policy shock).

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[3] In most cases unit roots tests indicated that after accounting for deterministic trend the variables used in the analysis were stationary and estimated VARs were stable.

[4] Monetary policy shocks are usually identified in different manner, like in (Sims and Zha, 2006), utilizing information on GDP and price movements.

Results for Poland

First, we focus on Poland – a country, which experienced the pronounced and representative changes in the structure of savings, including a substantial fall in overall savings, being to a large extend driven by a significant fall of household savings with a counteracting rise of corporate savings. Then, after highlighting the most important results, we will try to show whether they are present in other European countries.

Figure 3 Reaction of savings to real interest rate increase in Poland

Orthogonal Impulse Response from r

90 % Bootstrap CI, 10000 runs
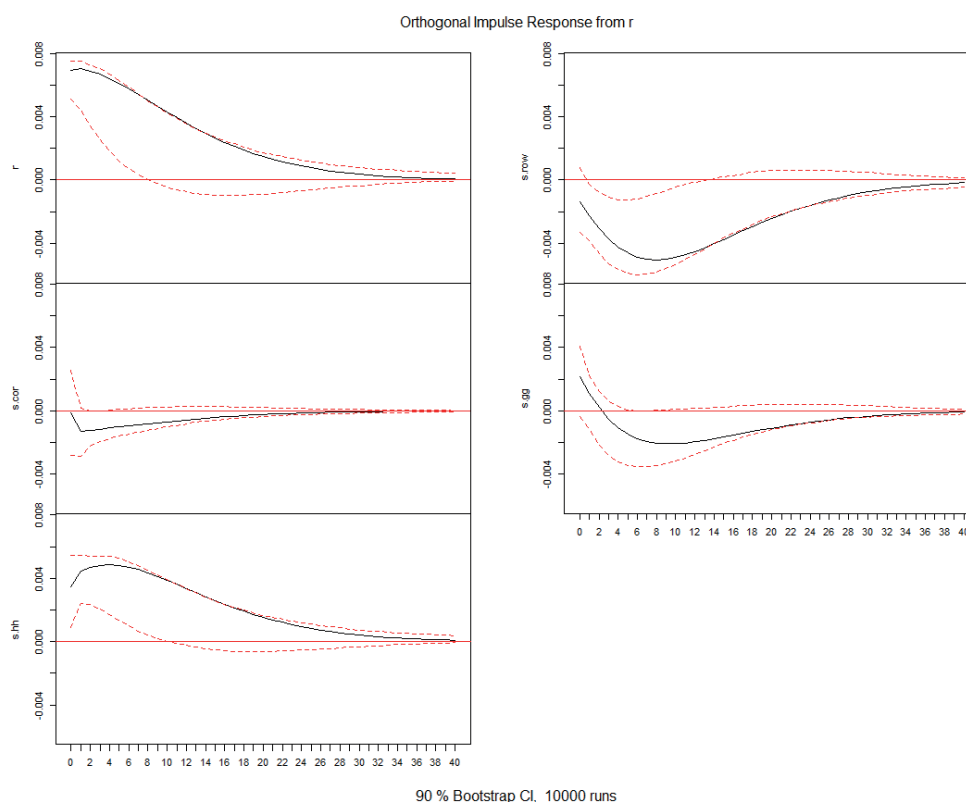
Source: own calculations based on vars package of R (Pfaff, 2008)

Figure 3 shows the IRF (impulse-response function) of saving rates of various sectors to real interest rate increase. First thing to note is that interest rate impulse is

quite persistent and fade outs after a couple of years, which implies that savings adjustments tend to be long-lasting either. Second important observation is that household savings respond exactly like the permanent income theory (Friedman, 1957) predicts – they increase for a period approximately equal to a period of high interest rate. Third important observation is that savings of other institutional sectors decline (although not always in a statistically significant manner) in reaction to an increase of real interest rate.

The most important reason why savings of enterprises, government and ROW fall with an interest rate increase is related to a specific role interest rate play in modern economies – namely – it is an instrument of monetary policy. It rises[5] when central bank wants the economy and prices to cool down. In effect – the level of economic activity declines, together with government tax revenues, corporate sales and imports. But let us concentrate on each sector separately. Government savings, adjust to higher interest rate in line with automatic stabilizers – lower level of economic activity induce a decline of tax revenues and an increase of some cycle-related spending (e.g. unemployment benefits). Moreover, higher interest rate increases debt service costs, adding to a decline of government savings. Undoubtedly, not all government revenues decline and expenditures increase, but on aggregate savings decline after interest rate increase.

The adjustment of foreign savings is more complicated and its direction is *a priori* ambiguous, as there are different forces at play. Firstly, on the financial side of the balance of payments the increase of interest rates should lead, *ceteris paribus*, to a decline of net capital outflows, inducing an increase of foreign savings. Secondly,

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[5] Nominal interest rate is a monetary policy instrument, but effectively for the central bank to affect real activity changes in nominal interest rate need to translate into real rates. This is so called Taylor principle (Taylor, 1993), which is usually confirmed by the empirical literature. Moreover, our identification strategy defining shocks to interest rates as unrelated, at least in the short run, to shifts in savings and investment schedules, facilitates this interpretation.

adjustments on the current account act in the opposite direction. Falling level of economic activity following an interest rate increase is translating into falling absorption, which induces a fall of imports. As exports should be rather unresponsive to interest rate increase the current account should improve, which is mirrored in an increase of net capital outflows and a fall of foreign savings. (Kang and Shambaugh, 2013) indeed point that empirically variation of current accounts is to a large extend driven by cyclical factors (increasing with a fall of GDP e.g. with interest rates increase). Finally, there is additional channel of adjustment, namely exchange rate. Uncovered Interest Parity condition, which is often used to describe short-term exchange rate movements, implies that exchange rate should depreciate with an increase of interest rate, amplifying improvement of current account. Adding pieces together, the natural tendency (stemming from adjustments in the capital account of the balance of payments) for net capital outflows to decrease with interest rate is (at least in the short run) dominated by both the depreciation of the exchange rate and falling imports, implying a fall of foreign savings.

The discussion in the literature overview highlighted that corporate savings can be thought of as retained profits. It follows that the reaction of savings of corporates to interest rate increase depends on the adjustments of profits. The direct effect operates on the cost side and is of course negative – debt services costs are increasing, translating into falling profits. But there is also an indirect effect, stemming from the fact that heightened interest rates are associated with lower level of economic activity, which affects both revenues and costs. Revenues drop in line with falling sales, but a fall of production also translates into falling costs, making an overall effect on profits undetermined *a priori*. However, the empirical literature (see e.g. (Knoop, 2015)) finds profits to be procyclical, which implies that corporate revenues drop more than costs. There at least two forces at play. First, some important cost categories – costs of labor and capital are hard to adjust in the short term (both in quantities and prices). Second, reaction of profits also depends on pricing behavior of firms and cyclicality of markups (measuring monopoly power of the enterprise). The literature

(see the discussion in the literature overview) gives somehow mixed picture, but rather finds price markups procyclical, implying that during recessions prices fall more than marginal costs, amplifying procyclicality of profits.

Figure 4 Time-variable IRF of domestic savings to an increase of real interest rate
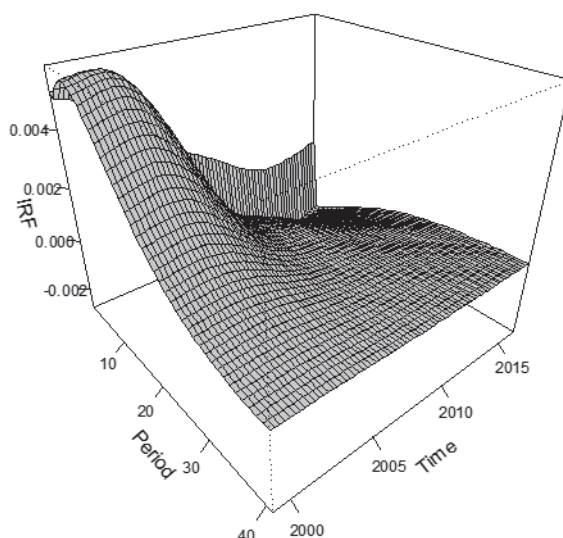
Source: own calculations,
Remarks: time indicate year of IRF measurement, period is the moment after the occurrence of the interest rate shock, the IRF axis measures the reaction of saving rate (0.01 = 1 pp.)

The way we specify SVAR model allow us additionally to construct a time-varying reaction of domestic savings and investment[6] rates to interest rate changes. As the domestic savings are composed of household, corporate and government ones, the IRF of domestic savings can be expressed as weighted sum of component

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[6] Investment is calculated as sum of domestic and foreign savings, so more precisely: gross capital formation.

responses. So, it is possible to construct response of aggregated saving rate using different saving weight for different periods. Such exercise assumes that responses of different sectors do not change over time, but the relative importance of sectors in savings generation shifts, inducing shifts in response of aggregates, such as domestic savings or investments. Figure 4 and Figure 5 show the results of this procedure for responses of domestic saving and investments rates. As the saving rates used for weighting exhibit some short-term volatility and we are interested in secular shifts, we used HP-filtered data for weighting (with standard value for λ, implying 10-years cut-off frequency of the filter).

Figure 5 Time-variable IRF of investment rate to an increase of real interest rate
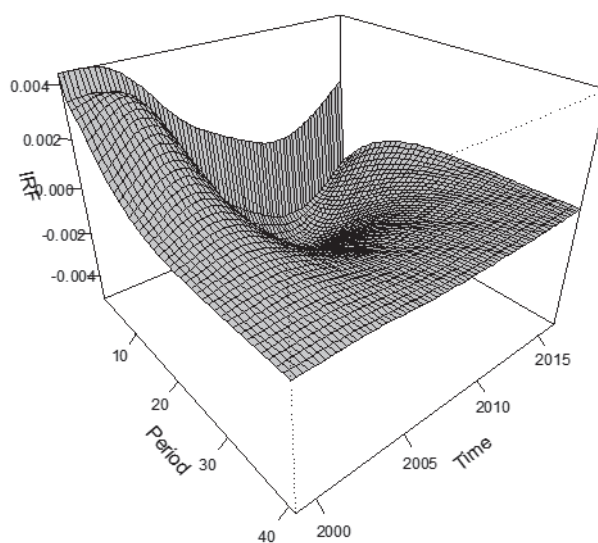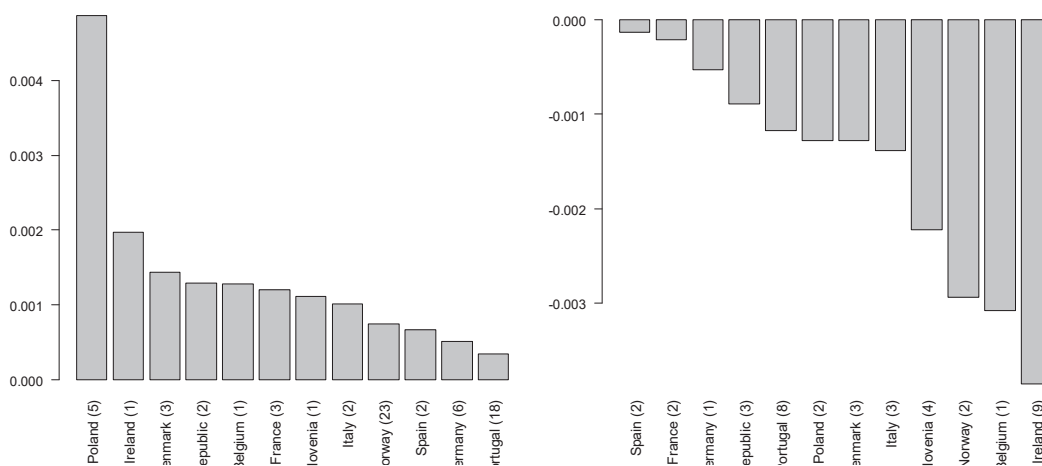

Source: own calculations,
Remarks: time indicate year of IRF measurement, period is the moment after the occurrence of the interest rate shock, the IRF axis measures the reaction of investment rate (0.01 = 1 pp.)

Figure 4 shows that changes in the savings structure translate into substantial changes in domestic savings responses to interest rate shock. In the first half of 2000's, when the importance of household savings was high, domestic savings rise with an interest rate increase. However, as the role of households in savings generation declined in favor of mainly corporates sector, the responses of domestic savings first started to be muted, and since the second half of sample – became negative and much less persistent. Similar picture emerges for the investment rate, as seen in Figure 5.

Multi-country results

The SVAR analysis for Poland suggest that interest rate increase results in higher household savings, but induce also a simultaneous decline of corporate savings, implying a negative conditional correlation, $corr(s_{HH}, s_{COR}|r) < 0$. The important question, is: do these results apply only for Poland? Although the individual shapes of IRF functions were different, the negative conditional correlation seems to be present in the whole analyzed sample of 16 countries (see footnote 2), although for further analysis we excluded 4 cases (Finland, Netherlands, UK and EA). Those excluded cases were due to econometric problems with VARs, indicating economically implausible sign of household savings response.

Figure 6 Maximum response of household savings (left panel) and minimum response of corporate savings (right panel) to interest rate shock.
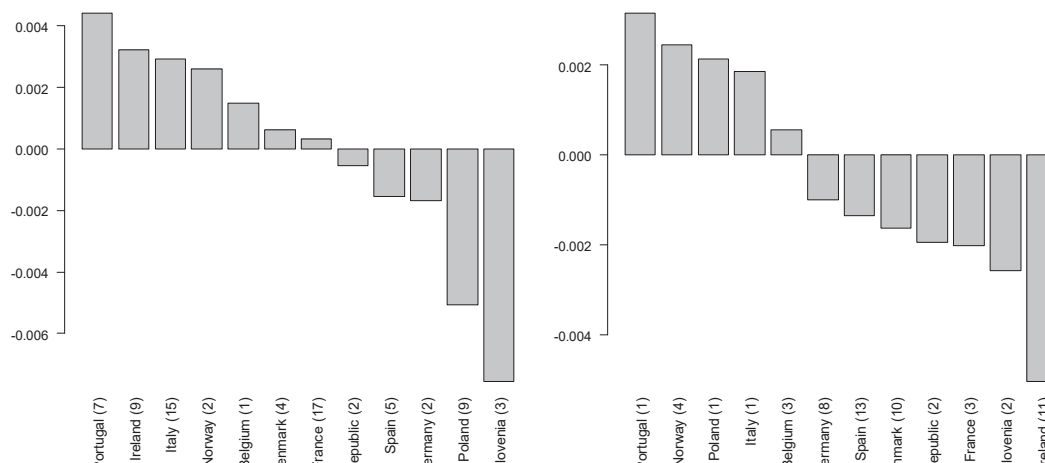

Source: own calculations,
Remarks: in parenthesis – period of max/min response

Figure 6 depicts both the maximum (left panel) response of household savings and minimum (right panel) response of corporate savings to interest rate shock (calculated over 40 periods, in all cases responses were close to zero thereafter). This

is a condensed way to show most important information from diversified IRF functions. They clearly indicate negative conditional correlation. Moreover, the parenthesis near country names give the information on timing of those maxima/minima. In case of household savings responses maxima usually occur either on impact or with 2-6 quarters lag (so with a hump-shape – e.g. in case of Poland the maximum occurred after 5 quarters – see Figure 3 for comparison). Only for Norway and Portugal the adjustment was more persistent. In case of corporate savings, the adjustment to interest rate increase is usually faster – the minimum response tends to occur no later than 1 year after the impulse (except Portugal and Ireland, with a 2-year lag). The results also reveal substantial heterogeneity in terms of the scale of adjustment, although the detailed discussion is beyond the scope of the paper.

Figure 7 Maximum absolute responses of foreign savings (left panel) and government savings (right panel) to interest rate shock.
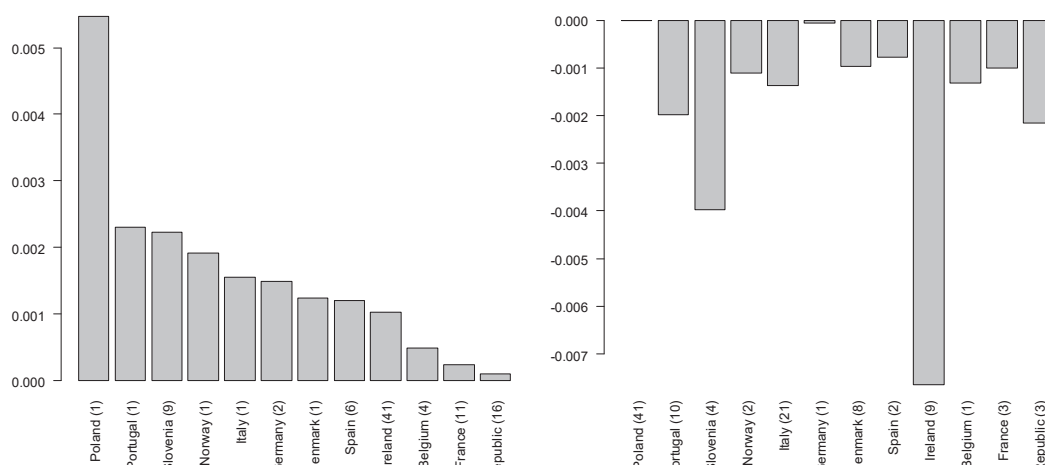

Source: own calculations,
Remarks: in parenthesis – period of max/min response

The results for Poland also indicate that the negative conditional correlation with household savings is observed also for foreign and government savings, but the results of multi country analysis does not confirm this finding to be universal. The careful inspection of individual responses (not presented here due to brevity) suggest

substantial heterogeneity of responses among countries, both in shape and sign. Figure 7 tries to simplify this heterogeneity, depicting maximum absolute responses of both foreign and government savings[7] and clearly indicates that those may either increase of decrease after interest rate increase. The timings of maximum absolute responses are diverse, indicating additionally the variety of IRF shapes. Although the discussion on differences among countries is beyond the scope of the paper, a quick look at the results shows no clear pattern. Foreign savings response seems to be unrelated either to exchange rate regime or NFA position of the country and government responses unrelated to the level of public debt.

Figure 8 Maximum (left panel) and minimum (right panel) responses of domestic savings to interest rate shock.

Source: own calculations,
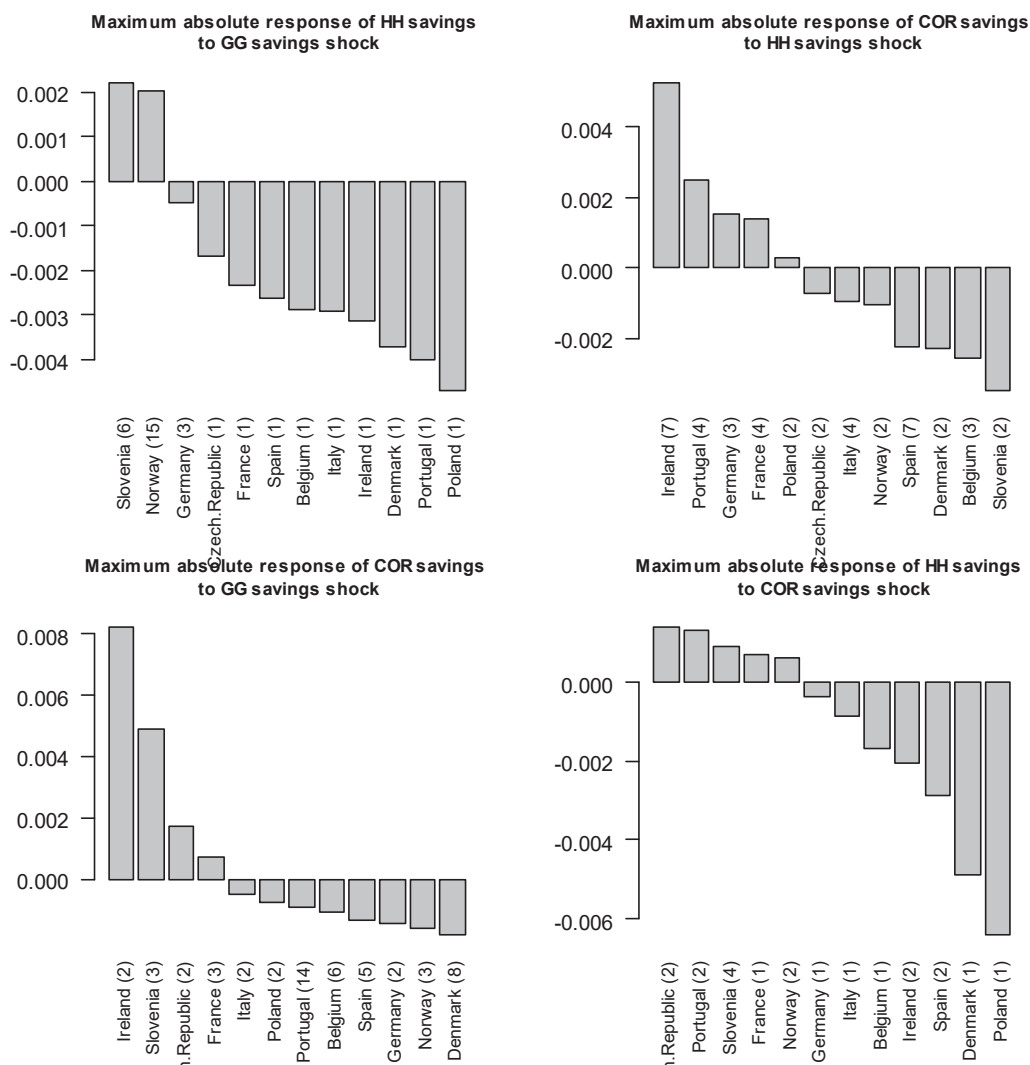*Remarks: in parenthesis – period of max/min response*

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[7] This is not an ideal way to show the heterogeneity, as e.g. Poland is classified in Figure 7 as having positive immediate maximum absolute response, whereas a closer look at Figure 3 shows that for most of the time government savings decline after the shock and in the detailed discussion on Poland it was highlighted that government savings declined.

The results of the analysis suggest that after an interest rate shock an increase of household savings is at least partly counterbalanced by declines of corporate savings, and the direction of adjustment of foreign and government savings vary across countries. Figure 8 shows the sum of those adjustments, the response of domestic savings, both in terms of maximum and minimum. For most of the countries considered positive adjustments of household savings dominates and domestic savings increase after interest rate rise. In case of Slovenia, Ireland, France and Czech Republic positive reaction of household savings is dominated by negative adjustments of mainly corporate, but also government savings (especially outstanding are Ireland and Slovenia, where responses are driven by substantial drops of responses of both corporate and government savings).

Although the identification of shift to saving demand schedules of different sectors was not the focus of the paper, it seems interesting to check what are the adjustments of one sector's savings to shifts in other sector's savings and whether there are any counterbalancing effects. Figure 9 depicts maximum absolute responses of household and corporate sectors' savings to shocks to savings of government, household and corporate sectors. The first observation is that within the analyzed sample there is no universal "crowding-out" effect present in all countries. Only in case of an increase of government savings, in 10 out of 12 countries there is a negative adjustment of household savings, which suggest that the textbook "crowding-out" effect is present almost everywhere. But it is visible only in case of household reaction – corporate savings fall much less, and only in a limited subsample of countries. Also, the mutual "crowding-out" of corporate and household savings is present in some countries, but it is not a universally observed phenomenon.

Figure 9 Maximum absolute responses of various sectors' savings to shocks to other sectors' savings

Maximum absolute response of HH savings to GG savings shock

Maximum absolute response of COR savings to HH savings shock

Maximum absolute response of COR savings to GG savings shock

Maximum absolute response of HH savings to COR savings shock

Source: own calculations,

Remarks: in parenthesis – period of max/min response

Conclusions

(Chen et al., 2017) convincingly documents that last decades brought substantial shift in sources of savings on a global scale, especially a fall in household and a rise of corporate savings. Therefore, household sector is no longer the main source of savings in economies. As the theory of savings mainly concerns households, we tried to assess how different agents populating the economy (households, corporates, etc.) react to interest rate changes to check whether the reaction of the economic system to interest rate changes over time. To address that issue, we proposed a data-driven approach, using SAVR methodology with identification scheme that tries to disentangle price changes (interest rate shocks, that are partially due to monetary policy changes) from shifts of saving demand schedules.

We find that responsiveness of savings to interest rate is diversified among analyzed 12 European countries. But there are some regularities. In line with standard macroeconomic theory (see e.g. (Friedman, 1957)) household savings rise after an interest rate increase. But the savings of other sectors can behave differently. In all countries analyzed corporate savings fall, exhibiting a negative correlation with household savings, conditional on interest rate shocks. The fall of corporate savings is related to the fact that corporate profits tend to decline with interest rate increases and are procyclical. The adjustments of government and foreign savings can be both positive and negative and the sign of conditional correlation does not seem to be related to factors like membership in currency union or the level of debt.

The diversity of savings adjustments suggest that domestic savings adjustments may also be diversified among countries. And it is indeed the case. For most of the countries analyzed positive adjustments of household savings dominates and domestic savings increase after an interest rate rise. But in case of Slovenia, Ireland, France and Czech Republic the opposite is true. We also try to check whether "crowding-out" effects (increases of one sector savings counterbalanced by a fall of other sector savings) are present in European countries and find that only the effect

of government savings crowding out household ones is present in most of countries (in 10 out of 12).

As we observe heterogeneity in responses of different sectors savings to interest rate increases and we observe changing structure of savings, it both indicates we should observe time changes of responsiveness of aggregate (domestic) savings. This is indeed the case in many countries and we documented that in case of Poland – a representative (in our view) country, which experienced pronounced changes, including a significant fall of household savings and a counteracting rise of corporate savings. We documented that in the first half of 2000s, when the role of household savings was high, domestic savings rise with an interest rate increase. However, as household role in savings generation declined in favor of corporates sector, the responses of domestic savings first started to be muted, and since 2008 – became negative and much less persistent.

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