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# Has there been a change in household saving behavior in the low inflation and interest rate environment?

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## Abstract

This paper examines whether the determinants of household saving have changed over time and whether they are the same across countries. Using a cross-country data for 34 OECD countries for the 1970-2019, we find that traditional saving rate specifications still perform strikingly well and can explain the recent changes in household saving rates. As for the cross-country differences in equilibrium saving rates, we have less success even though the basic estimating equation seems to fit reasonably well to individual country samples. We found that household saving is still very sensitive to changes in inflation and real income growth. Thus, decline in the household saving rate in the 1990s can mainly be attributed to these variables. Obviously, a decline of real interest rate has also pushed down the saving rate. Households seem to have reacted to changes in public sector as well as corporate sector saving so that there has been nontrivial degree of saving substitutability.

**Keywords: household saving, private saving, inflation, debt neutrality**

**JEL codes: E21, G51**

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# 1. Introduction

Household saving is important for many reasons: it (1) provides information of future perception of consumption and income (in the sense of "saving for the rainy day"), (2) it determines future development of household indebtedness, (3) it provides information of the magnitude of debt neutrality; i.e. how much households pay attention to the developments of public debt (and higher taxes in the future), (4) its behavior indicates how much substitution there is between household and corporate savings[1], (5) it provides information of the interest rate sensitivity of household behavior and, finally, (6) it provides information of life-cycle behavioral patterns of households.

That is why it is useful to revisit household saving function estimates to see whether the traditional behavioral relationship still works in the same way as earlier. It is also worth reconsidering the cross-country differences between countries to see the magnitude of these differences both from the data and after controlling the saving rate with an appropriate set of control variables. Recent surge of inflation also calls for analysis of eventual effects on household consumption and saving behavior.

In the past, there have been several cross-country analyses of which we might mention at the least the following: Callen and Thimann (1997) and Rocher and Stierle (2015). In addition, we may mention Edwards (1995) and Ferrucci and Mirales (2007) who focus on this question from the point of view of private saving. All afore mentioned studies use a similar panel data set-up with annual cross-country data with different choices of countries and sample periods. In any case, most of countries are from Europe. The sample periods vary more but none of the studies make use of more recent (say, beyond 2012) data. Some interesting insights are also provided by recent micro data analyses with consumption, income and wealth variables (Eurostat 2021).

Here we use the maximum amount of household data from the OECD countries that cover the period 1970-2019. In addition to the household data, we also focus on the corporate sector saving (i.e. profits) and thus the private sector saving rate. The two saving rate series are shown in Figure 1. In both series, there are some declining tendencies and quite a lot of variability. No surprise that both properties are more prominent with the household saving rate.

Next, we first describe the data and the empirical analysis. Then we present a summary of the results, and finally, in section 4, some concluding remarks.

[1] Saving substitution would be particularly relevant for owners of small businesses where the borderline between household income and income from the firm is sometimes rather unclear. Then the question is whether the household saving rate or the private saving rate is the proper indicator and whether the household income or the private sector income is relevant for private consumption and saving.

## 2. Analysis and data

The empirical analysis is carried out in a customary way by estimating a saving rate equation from cross-country panel data. Because we are dealing with sectoral income accounts we cannot have a large set of countries and we have to use mainly annual data. In our case, we have data for of 34 countries and these cover the time period 1970-2019. Most of data come from the OECD although some other data sources are used, mainly for the control variables. For robustness purposes, we also use quarterly data for the Euro area 1995Q1-2019Q4.

The estimating equation for the saving rate takes the following form:

$$sr_{it} = \alpha_{0it} + \alpha_1 sr_{it-1} + \alpha_2 yd_{it} + \alpha_3 \pi_{it} + \alpha_4 rr_{it} + \alpha' X_{it} + \mu_{it}, \quad (1)$$

where sr is the saving rate, yd household real (disposable) income growth, π inflation and rr the real (long-term) interest rate, X the set (vector) of control variables and μ the error term. Subscript i denotes country and t time (year).

The model is basically an extended version of the Deaton (1977) model where the driving force is inflation and more precisely consumers' inability to distinguish individual commodity price increases from overall inflation (basically the same idea as in the Lucas' isolated islands' model of aggregate supply). If prices increase, people experience these increases as increases on relative prices of goods that they are sampling. Thus, they reduce the demand for these goods and that leads first to a fall in aggregate consumption demand, which in turn translates to an increase in the saving rate. In the saving rate equation, the key variables are then inflation and real income growth. Real income growth variable is a key ingredient of the Deaton model but it could be rationalized also by the fact that income growth might increase more the savings of those working relative to those not working, or more generally increase the savings of high-saving rate households relative to low-saving rate households. As for the real interest rate, we face the well-known ambiguity between conflicting income and substitution effects not to speak of various measurement issues. Still, we might expect that the substitution effect dominates and the savings effect is positive.

The cross-country mean values of these variables are displayed in Figure 2.[2] As for the controls (see Table 1), we have a set of variables which reflect the structure of economy. The list of variables are more or less the same that appear in earlier studies of household saving behavior. We discuss the motivation behind each variable in the same context as we discuss the estimation results for these variables. The details of the data for all variables are explained in Table 1, which explains the exact definitions and data sources.

[2] Even though there ae some trendlike features in the cross-country mean values of the key time series, the assumption of a unit root (either a country specific or a common) could be rejected with all of those variables.

Quite clearly the key RHS variables of (1) can have simultaneous relationships with each other and with the saving rate, in particular. We tried to solve the problem by using conventional econometric tools (lagged values & Instrumental variable estimation), but as it turns out in the next section, the results did not appear to overly sensitive with respect to these alternative approaches. Of course, there is the caveat that it is not easy find instruments which would be completely immune to simultaneous relationships vis a vis an aggregate savings type macro variable.

The equation is estimated by both OLS and Arellano-Bond GMM using different panel-data set-up. In a preliminary testing phase, we found that the random-effects specification was not supported by the data (given the Hausman test for country-specific factors). Thus, we use the fixed effects specification, but also consider the case with no fixed effects.

## 3. Estimation results

The main results are tabulated in Table 2. Besides estimating equation 1 we estimate a static version of that in order to see how well we can explain the levels of country differences. Thus, we drop the lagged value of saving rate, household indebtedness, inflation and income growth from the estimating equation, which then only include the control variables on the right-hand-side. See columns 8-10 in Table 2. Scrutiny of the respective results reveals that we cannot really account for most of household saving rate differences over time and across countries. It is only if we introduce country fixed effects, $R^2$ increases to 0.85. With the fixed time effects $R^2$ is 0.49 and without all fixed effects 0.45. Most of the controls are statistically significant, but even then, the levels of saving seem to depend on some third (more complex institutional or cultural) variables.

Given this somewhat disappointing (even though old) result we turn to results with the dynamic specification.

In a dynamic version, the explanatory power is reasonable, particularly when we introduce the fixed country and period effects (columns 1, 5 and 6). The controls do increase the explanatory power but do not really change the key ingredients of the basic specification. Thus, we observe that the household saving rate depends very strongly (and positively) on disposable income growth, inflation and real interest rate. In fact, these results also apply to the private saving rate (column 4).

Equation (1) performs strikingly well also if we estimate the coefficients for individual countries separately (see Appendix 1 for details). Thus, for $\alpha_1$, all coefficients are positive, for $\alpha_2$ one (country) coefficient is negative, for $\alpha_3$ and $\alpha_4$ four coefficients (out of 34) are negative. The basic model (without controls) performs very well and is very robust in terms of sample

selection and estimation method (OLS vs. GMM). When the controls are introduced, the signs, significance and magnitude of the key variables do not change (table 2 columns 1-4). It is only that some of the controls are sensitive to the estimation method. Thus, if we use the GMM with first differences, variables like GDP per capita and the gross tax rate change the sign. When first differences of the data are used, the explanatory power of the basic equation remains very low (see column 2 in Table 2). This reflects the fact that the dominating feature of the data is just the very large cross-section dispersion of saving rates. Higher explanatory power within the panel data are only obtained by means of fixed effects and control variables. Notice however, that even though we difference the data, the main results of income growth, inflation and the real interest rate remain the same, which obviously tells something about the robustness of the basic model.

We also estimated equation (1) for the Euro Area using quarterly ECB data for 1995Q1-2019Q4. Again, the results followed the same lines as with the global cross-country panel. More precisely, the estimates were: constant 0.033 (5.33) $sr_{t-1}$ .720 (13.67) $yd_t$ .097 (2.98) $\pi_t$ .038 (1.04) and $rr_t$ 0.072 (2.17), $R^2 = 0.806$. These estimates again corroborate the predictions of Deaton (1977) even though inflation in the Euro Area has been relatively constant for the sample period (the standard deviation of the 4-quarter growth rate has been only 0.8 per cent while the mean has been 1.6 per cent).[3]

The positive association between real income growth and the saving rate means that consumption growth is much smoother than income growth because hikes in income are eroded by additional savings. Inflation works to the same direction (to the extent inflation depends on cyclical factors) also smoothing consumption. To some extent, consumption smoothing seems to be nonlinear. Thus, if we focus on the coefficient $\alpha_2$ for positive and negative values of real disposable income growth yd we find that the coefficient is seemingly very different as the following coefficient estimates indicate: $\alpha_2^-$ (which indicates the coefficient of yd|yd<0) = 0.261(1.65) and $\alpha_2^+$ (for yd|yd=>0) = 0.396(6.92). Even though the coefficients are not statistically different (according to the Wald test) they suggest that positive and negative change rates of income affect saving a bit differently. Thus, negative income shocks do not necessarily lower the saving rate but may even increase it due to the precautionary motive as a response to increased uncertainty; a conclusion that is consistent with recent experiences of the financial crisis and the Covid-19 pandemic (see Figure 3 for Finnish evidence)[4]. This conclusion is also

[3] We had also the basic data for China but not the controls. Therefore, China was not included into the sample. But the individual coefficients followed quite closely those obtained from the panel: more precisely, the estimate for $\alpha_1$ was 0.728 (4.95), for $\alpha_2$ 0.174(1.07), for $\alpha_3$ 0.074(1.47) and $\alpha_4$ -.166(0.95), $R^2 = 0.927$. Keep in mind that the sample mean of China's saving rate is 33.6 while the average for other countries is 5.0 %.

[4] In the early 1990s and 2008/9, the saving rate increased while income was falling. Similar developments took place during the first oil crisis in 1974/5 but not during the second oil crisis 1980/1 (this was probably due to different type of interest rate and inflation developments).

supported by the finding that if we also allow inflation – and even the real interest rate) to have a nonlinear effect on the saving rate we arrive at the following estimates:

**Box 1 Cross-county panel data estimates of a nonlinear saving rate equation**

$sr = -1.359 + .857sr_{-1} + .233yd^{-} + .404yd^{+} - .413\pi^{-} + .289\pi^{+} + .156rr$
$t_1 = 2.43$, $t_2 = 32.68$, $t_3 = 1.49$, $t_4 = 7.16$, $t_5 = 0.99$, $t_6 = 2.34$, $t_7 = 1.61$, $R^2 = 0.927$, SEE = 1.647, DW = 1.684,
$\chi^2_2 = 7.194$ (0.027).

$sr = -1.367 + .852sr_{-1} + .268yd^{-} + .396yd^{+} - .1793\pi^{-} + .196\pi^{+} - .3226rr^{-} + .241rr^{+}$
$t_1 = 2.41$, $t_2 = 32.13$, $t_3 = 1.64$, $t_4 = 7.09$, $t_5 = 0.57$, $t_6 = 2.21$, $t_7 = 1.20$, $t_8 = 2.11$, $R^2 = 0.929$, SEE = 1.621, DW = 1.691,
$\chi^2_2 = 25.772$ (0.000).

*Here, plus and minus superscripts indicate positive and negative values of the underlying variable. Both equations also include all controls and both time and country fixed effects.*

In these two cases, we can reject the linear model with the Wald test. The same result is obtained by including the control variables. So, we can say that savings respond disproportionally more to positive values of inflation and real income growth. Because of this nonlinearity, the saving rate channel provides only a partial "automatic stabilizer" for the economy in the sense that saving fails to adjust to a fall in income. Big negative shocks are almost always associated with increase in uncertainty and that leads to increase in precautionary saving and fall in private consumption which may further aggravate the cyclical situation. The effect of inflation and real interest rate on saving seems also depend on the sign of the effect: a significant positive effect is only detected when the values are positive while with deflation and negative real interest rates, a statistically significant saving rate effect cannot be found.

Although we find that the coefficients of the saving rate equation are sensitive to the values of the regressors, we find that the coefficients are strikingly robust in terms of time. Thus, the estimates for pre and post Lehman are, if not identical, very similar to the full sample period counterparts. This can be seen from the following estimates.

| **Box 2 Subsample estimates of key saving rate equation parameters** | | | | |
|---|---|---|---|---|
| sample | $sr_{-1}$ | yd | π | rr |
| 1970-2019 | .861 | .363 | .308 | .221 |
| 1970-2008 | .814 | .448 | .458 | .245 |
| 2009-2019 | .638 | .347 | .439 | .312 |

Here, all coefficients have t -ratios which exceed conventional levels of significance with the t-test. The full sample values are from Table 2, column 1.

So, one cannot really say that the sensitivity of saving with respect to inflation and interest rate would have diminished during the period of very low inflation and interest rates.

As for the controls, we can conclude that:

- the terms of trade tends always to increase saving; an increase in the terms of trade obviously means higher level of income in the country in question compared with other countries.
- the "deepness of credit markets" increases saving; this is something which is consistent with early findings of e.g. Goldsmith (1969) and McKinnon (1973).
- the share of public sector – measured by the share of public consumption out of GDP has an ambiguous effect: the "between effect" is negative but the "within effect" positive. Ambiguity might arise from the fact that part of public consumption is a substitute to private consumption. On the other hand, an increase in the size of government can be interpreted as an indication of higher taxes in the future.
- public sector surplus always decreases household saving which could be an indication of debt neutrality; households acknowledge that they must be prepared to smaller income (higher taxes) in the future
- household indebtedness increases household saving (as some sort of error-correction mechanism) but the size of the effect depends on other controls.
- the level of income per capita has a positive effect on saving.
- population growth increases saving along the lines of the "Modigliani story of aggregation". According to this hypothesis, aggregative saving can be positive even though individual life-time saving is zero because in a growing economy there are more savers than dis-savers with a typical life-time profile of individual saving where saving precedes dis-saving.
- self-employment has typically a positive effect on saving although with the GMM (and differencing the data) the effect vanishes
- corporate sector profits (i.e., corporate saving) have a negative effect on household saving, which is consistent with the old "saving substitution" story, in which the borderline between household and company income can be unclear - at least for small business owners
- the gross tax-rate has a negative effect on saving – the explanation may be connection to an increase in tax progressivity which ultimately follows from higher over-all tax rates, which leads to lower disposable income of high savers and more equal income distribution. Taxation of capital income which has become a commonplace nowadays effectively means double-taxation on returns from saving (Boadway and Wildasin 1994) that increases the price of future consumption relative to current consumption, which obviously hinders household saving.

- the effect of age-dependency ratio of ageing is quite weak probably reflecting the fact that the profile of the ratio in all countries is U -shaped due to high birth rates in the later 1940s and 1950s. If the ratio only reflected the share of old-age people, we would expect the effect to be negative (because the old-age people are typically dis-savers) but now we find some ambiguity with the respective results.

The results for all controls come very close to those in earlier studies, for instance those in Callen and Thimann (1997) that use data for 1975-1995. A couple of comments on the saving substitution effects might still merit note. If we try to arrange a more formal test for saving substitution hypothesis we could add the growth rate of profits (not the level as in Table 2) to the estimating equation (1). The problem is that profits (corporate sector income) have several negative values. Here the variable (denoted by $\Delta$profit) is proxied by the difference in real profits in relation to household disposable income. The following estimates were then obtained (equation 2).

$$sr = -1.823 + .869sr_{-1} + .281yd + .231\pi^{+} + .126r^{r-} - .249\Delta profit \qquad (2)$$

$t_1$ =1.77, $t_2$=35.79, $t_3$=6.09, $t_4$=2.42, $t_5$=1.38, $t_6$=7.17, $R^2$=0.944, SEE=1.437, DW=1.876.

The key parameter has the value -0.249 which suggests the growth of profits does indeed depress household saving. In other words, households take into account the increase in wealth (future dividends) in the corporate sector. This behavioral pattern may also explain why household saving rate often (see e.g. Figure 3) collapses in boom periods. Obviously, changes in income growth expectations do the same (cf. Campbell 1987). It is only that when this “saving for the rainy day” hypothesis is tested, the focus is typically on household disposable income only.

It is interesting to compare the model predictions with the actual saving rate for different countries. Because of the important role of fixed effects and the persistence of the saving rate, it is a bit difficult to arrange a meaningful forecast accuracy analysis. Thus, we just compare the sample mean values of the saving rate with the country fixed effects from the equation 5 in Table 2. The comparison is shown in Figure 4. Quite clearly, in most cases the fixed effect is only a small fraction of the mean value of the saving rate, and in some cases (most notably in Luxemburg and Norway) the sign is different. This could be interpreted in the way that in these countries, the model (the right-hand side variables of (1)) would produce much higher saving rate than the observed one.

Finally, we also compared the saving rates and fixed country effects of the saving rate equation with the proxies of shadow economy computed by Medina and Schneider (2019). With the saving rates, we found that the sample average of the saving rates correlated quite strongly and negatively with the shadow economy share estimates (also in terms of rank correlation), which is consistent with the hypothesis that at least part of negative saving (“over

consumption) is financed by shadow income. The problem is only that the negative saving rates come from Eastern Europe (previous Soviet bloc countries) plus Greece for the last ten years (see the lower left corner of Figure 5). For other countries, the relationship is very weak at the best (see Figure 6). One may argue, however, that the big negative saving rates were just temporary phenomena which does not fit well into the prototype of a shadow economy. The data reported in Callen and Thiemann (1997; see Appendix 2) shows that for 1975-1981 household saving rate in Greece was 22.1 % and prior 1995 the saving rate as the highest among OECD countries (18.3 %). For the last 10 years, the mean value is -12.3 %, however. Also Italy and Portugal has been among the top four household saving rate countries while also being at the top of the shadow economy rankings (see Oinonen and Viren 2021 for details)[5].

## 4. Conclusions

We have found that household saving is still very sensitive to changes in inflation and real income growth. Thus, decline in the household saving rate after the 1990s can mainly be attributed to these variables. Obviously, a decline of real interest rate has also worked to the same direction. Households seem to react in a "correct way" to changes in public sector size and balance as well as corporate sector saving so that there is some degree of saving substitutability which could have partly compensated the developments of inflation and interest rates. The study again finds that cross-country differences in "equilibrium" saving rates are very large and cannot fully be explained by a conventional set of control variables.

[5] The Medina & Schneider (2019) data cover 1995-2017. Correlation coefficient between the mean values of household saving rates and the Medina & Schneider (2019) measures of shadow economy is -0.49 but correlation between the country fixed effects (equation 4 in Table 2) and the shadow economy measures is of an opposite sign and of the value 0.24.

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## Table 1 Descriptive statistics of the data

| | | | Mean | Me-dian | Maxi-mum | Mini-mum | Std. Dev, |
|---|---|---|---|---|---|---|---|
| ad | Age-dependency ratio (w) | % | 49,60 | 49,57 | 66,46 | 36,21 | 4,69 |
| pb | General government surplus (o) | % | -0,19 | -0,01 | 15,72 | -29,85 | 3,71 |
| cpi | Consumer price index inflation (o) | % | 2,31 | 1,97 | 23,47 | -4,48 | 2,44 |
| gq | GDP share of public consumption (w) | % | 19,58 | 19,48 | 27,94 | 10,91 | 3,12 |
| credit | Credit/GDP ratio (w) | % | 95,99 | 92,44 | 221,29 | 0,19 | 46,06 |
| emp | Self-employment ratio (w) | % | 14,64 | 13,78 | 36,99 | 6,25 | 5,60 |
| gdp | GDP growth rate (o) | % | 2,42 | 2,45 | 25,38 | -14,84 | 2,99 |
| gdppc | GDP per capita (w) | USD | 39526 | 40105 | 111968 | 5339 | 21891 |
| hhd | Household debt/income (o) | % | 115,21 | 106,67 | 339,78 | 4,33 | 64,25 |
| pop | population growth rate (w) | % | 0,39 | 0,37 | 2,89 | -2,26 | 0,70 |
| profit | corporate profits (o) | USD | 799 | 666 | 10829 | -6463 | 10812 |
| sr | Household saving rate (o) | % | 4,96 | 5,61 | 18,80 | -33,38 | 6,01 |
| rr | Long-term real interest rate (o) | % | 1.84 | 1.81 | 21.00 | -8.97 | 2.41 |
| srp | Private saving rate (o) | % | 8,42 | 8,30 | 26,63 | -7,66 | 3,95 |
| tax | The gross tax rate (o) | % | 35.33 | 34.80 | 48.77 | 22.38 | 5.36 |
| tt | Terms of trade (o) | index | 1,00 | 1,00 | 1,62 | 0,57 | 0,10 |
| yd | Growth rate of HH real disp. income (o) | % | 2,23 | 2,16 | 20,82 | -12,71 | 2,87 |
| yp | Growth rate of private real disp. income (o) | % | 3,82 | 3,69 | 16,85 | -11,73 | 3,33 |

In the analysis, the nominal USD values have been deflated by US CPI. Data sources are the OECD data bank (o) and World Development Indicators (w). Inflation is her denoted by cpi.

## Table 2 Basic estimation results with the saving rate equation

| variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| c | -1.397 | | | 2.305 | -13.507 | -10.042 | | 1.705 | -13.88 | 1.957 |
| | (2.51) | | | (2.42) | (3.73) | (2.78) | | (0.55) | (2.60) | (0.69) |
| $sr_{-1}$ | .861 | .191 | 0.803 | .803 | .695 | 0.693 | 0.716 | | | |
| | (22.65) | (3.10) | (10.00) | (22.64) | (23.58) | (16.04) | (4.16) | | | |
| yd | .363 | .288 | 0.506 | .326 | .355 | .350 | .551 | | | |
| | (6.38) | (5.00) | (7.47) | (10.27) | (9.67) | (5.50) | (6.13) | | | |
| cpi | .671 | .222 | 0.387 | .291 | .352 | .356 | .366 | | | |
| | (4.73) | (2.14) | (2.55) | (3.25) | (4.500) | (2.22) | (3.28) | | | |
| credit | [.007] | | | | .010 | .010 | .010 | .011 | .022 | .018 |
| | (2.26) | | | | (2.15) | (2.35) | (0.67) | (2.36) | (4.47) | (3.70) |
| tt | [.643] | | | | 2.830 | 2.099 | 8.648 | 3.261 | 8.033 | 2.487 |
| | (0.90) | | | | (2.62) | (2.13) | (3.16) | (2.75) | (7.47) | (2.09) |
| gq | [.176] | | | | 0.299 | | .570 | -.565 | .190 | -.639 |
| | (2.61) | | | | (2.92) | | (2.59) | (6.00) | (1.34) | (6.45) |
| pb | [-.108] | | | | -.045 | -113 | -0.332 | -.354 | -.139 | -.297 |
| | (3.57) | | | | (1.15) | (2.65) | (2.75) | (5.98) | (2.94) | (5.09) |
| rr | .214 | .310 | 0.318 | .263 | .271 | .264 | .213 | -.106 | .114 | -.441 |
| | (2.17) | (2.85) | (2.18) | (2.97) | (4.02) | (2.04) | (1.84) | (1.10) | (1.38) | (3.68) |
| $hhd_{-1}$ | [.019] | | | | .005 | 0.009 | -.028 | | | |
| | (4.73) | | | | (0.87) | (1.59) | (0.41) | | | |
| gdppc | [.050] | | | | .070 | .053 | -.021 | .024 | .040 | .013 |
| | (2.31) | | | | (4.67) | (3.42) | (0.22) | (3.64) | (2.13) | (1.92) |
| pop | [.311] | | | | .213 | 342 | -1.083 | 2.368 | .989 | 2.306 |
| | (1.31) | | | | (0.92) | (1.26) | (0.70) | (5.76) | (3.18) | (5.58) |
| emp | [.108] | | | | .095 | .120 | -.398 | .022 | .334 | .042 |
| | (2.58) | | | | (1.99) | (2.72) | (0.60) | (0.44) | (5.84) | (0.95) |
| profit | [-.489] | | | | -0.546 | -.541 | -.342 | .283 | -.313 | .332 |
| | (4.63) | | | | (7.73) | (4.21) | (1.33) | (5.92) | (4.17) | (7.05) |
| tax | [-.156] | | | | -.099 | -.036 | 1.078 | -.908 | -1.402 | -.900 |
| | (3.47) | | | | (1.70) | (0.67) | (1.93) | (7.27) | (8.09) | (8.87) |
| ad | [-.025] | | | | .005 | .032 | -.192 | -.029 | .196 | -.011 |
| | (1.14) | | | | (0.13) | (0.83) | (0.74) | (0.70) | (4.30) | (0.27) |
| Dep var | sr | $\Delta$sr | $\Delta$sr | srp | sr | sr | $\Delta$sr | sr | sr | sr |
| $R^2$ | 0.925 | 0.125 | 0.078) | 0.913 | 0.934 | 0.933 | 0.138 | 0.448 | 0.848 | 0.485 |
| SEE | 1.647 | 1.843 | 2.127 | 1.447 | 1.541 | 1.551 | 2.252 | 4.195 | 2.261 | 4.139 |
| DW | 1.684 | 1.964 | | 1.802 | 1.589 | 1.615 | .. | 0.242 | 0.741 | 0.272 |
| Hansen-J | | | 0.093[a] | | | | 0.383[a] | | | |
| Fixed | C&T | Difference | Difference | C&T | C&T | C&T | Difference | none | C | T |
| Estimator | OLS | OLS | GMM | OLS | OLS | OLS | GMM | OLS | OLS | OLS |

In the first equation, the values within brackets are coefficient estimates of control variables which are added to the basic specification in one-by-one manner. Otherwise, the estimates belong to the basic model without controls. Hansen J denotes the P value of the J statistic. With equation (3) the Arellano-Bond autocorrelation test statistics (both for AR1 and AR2) are clearly significant while with equation (7) they are not (the P values being 0.88 and 0.13). sr (srp) denotes the household (private) saving rate. The income growth variable in the srp equation (4) is the growth rate of real private (disposable) income yp. Inflation ($\pi$) is here denoted by cpi. C denotes cross-section and T period fixed effects. Difference indicates that the data are differenced. Numbers inside parentheses are robust t-ratios. The number of data points with the basic model is 742 and with the model with all controls 613.

**Figure 1 Mean values of the saving rates**

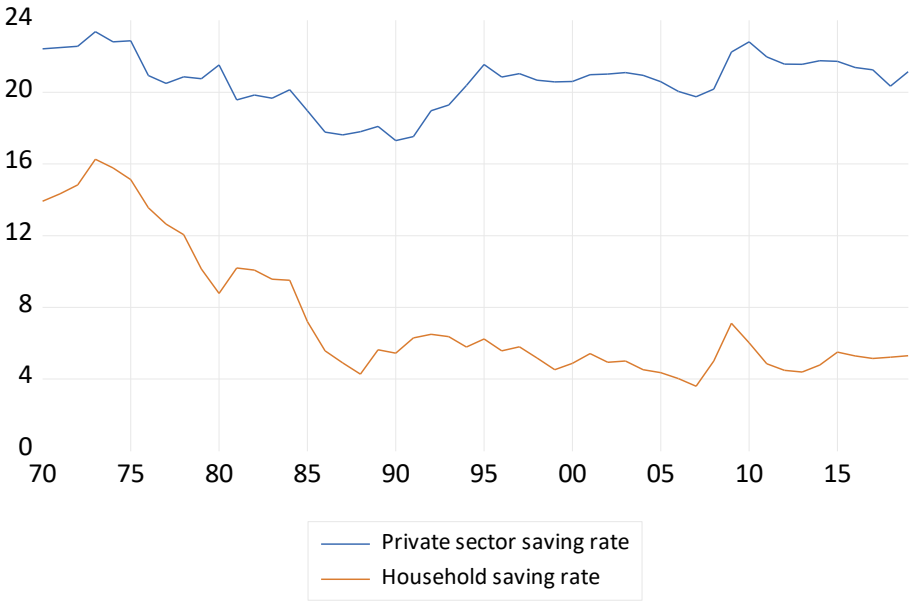



**Figure 2 Country mean values of the saving rate, income growth and inflation**

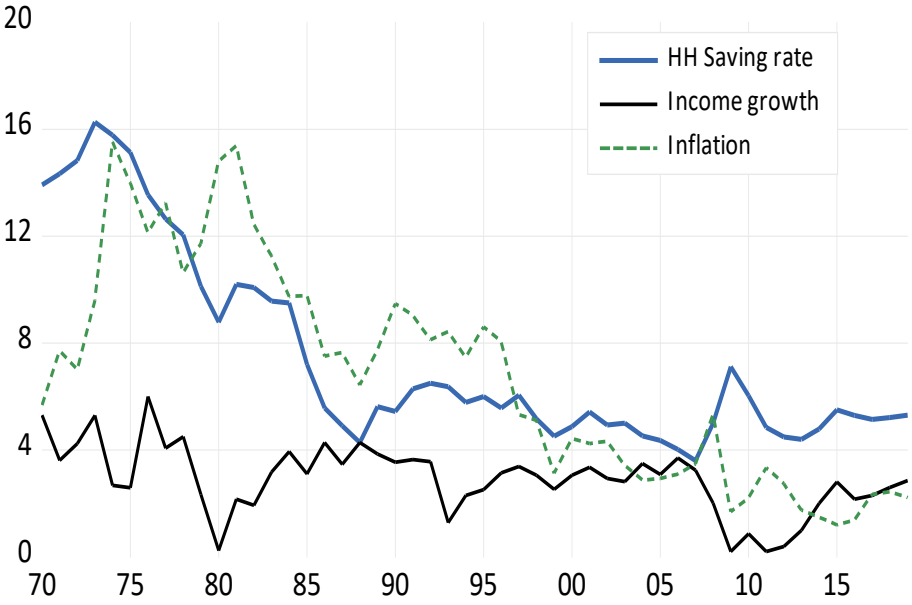


**Figure 3 Cyclical behavior of the Finnish Saving rate**

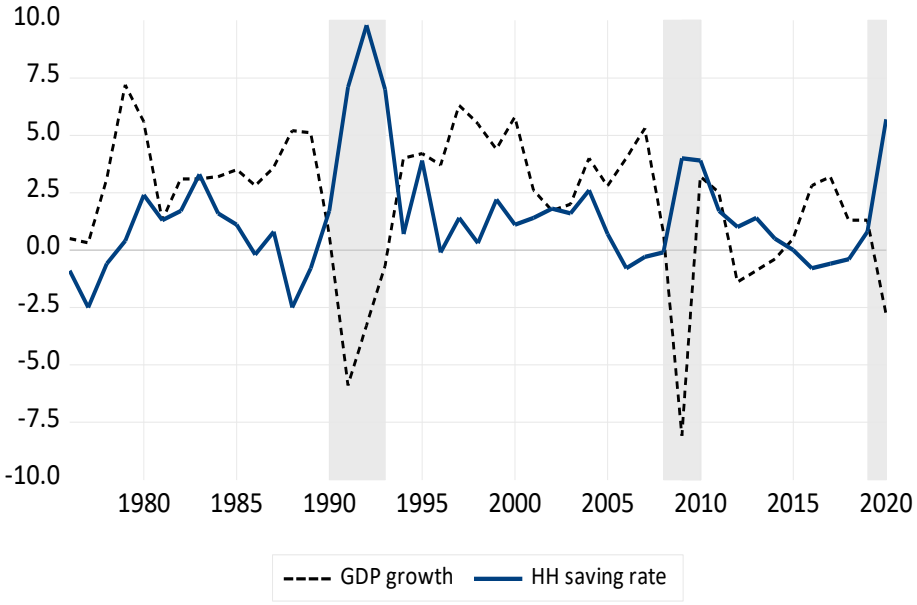
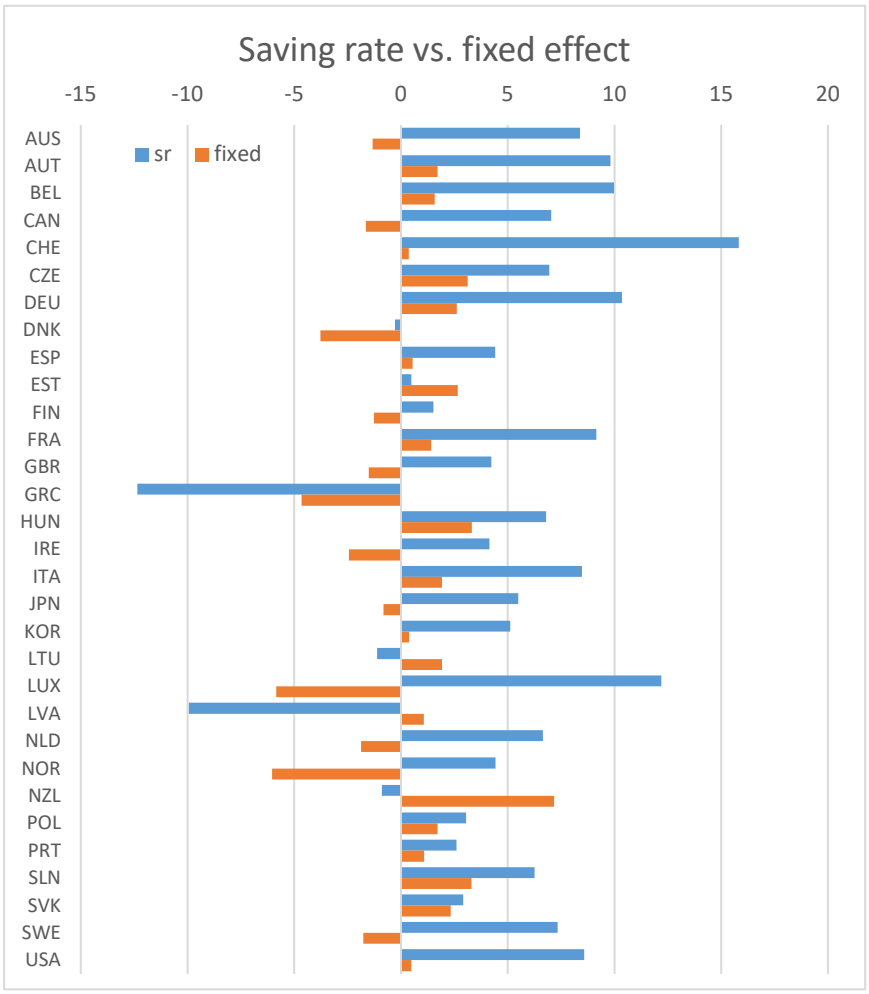



**Figure 4 Comparison of the saving rate and the corresponding fixed effect**




Correlation between the two series is 0.055.

**Figure 5 GDP per capita and the saving rate**

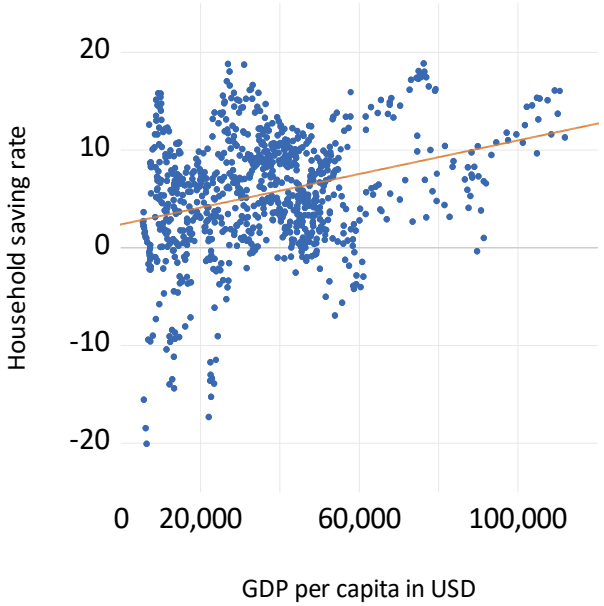
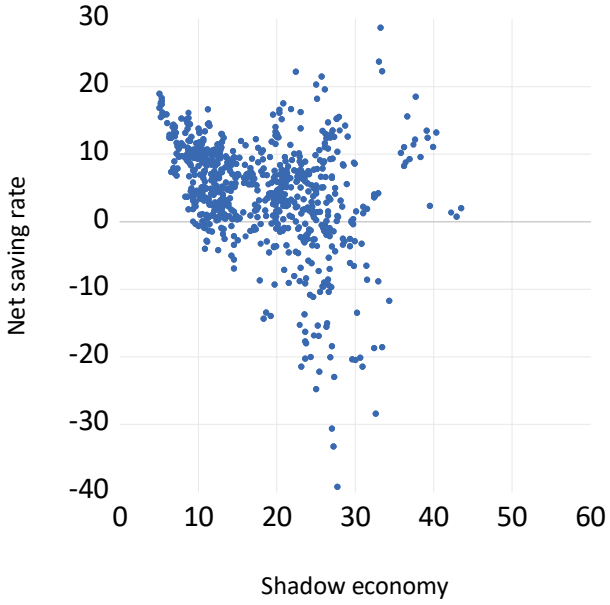


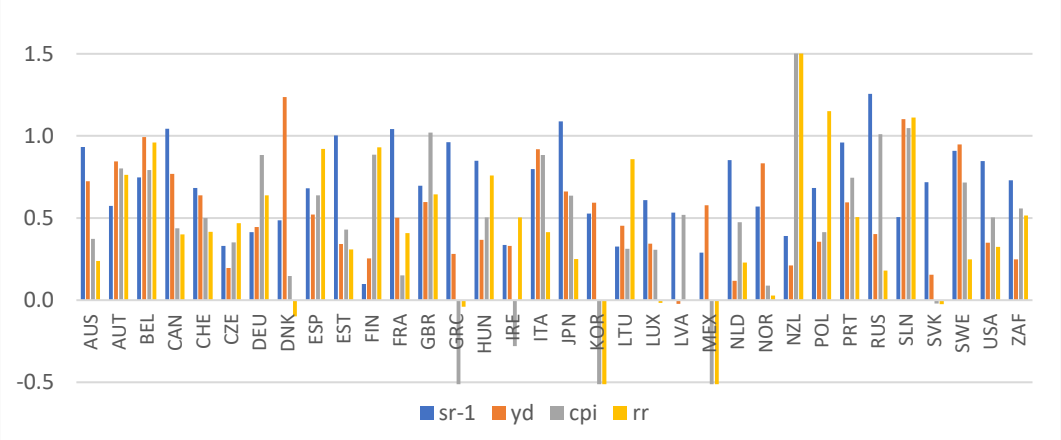

**Figure 6 Saving rate and Medina & Schneider shadow economy estimate**




The values cover the period 1991-2017 (Medina & Schneider 2019) .

## Appendix 1 Country- specific coefficients for the key variables

| $sr_{-1}$ | yd | cpi | rr |
|---|---|---|---|
| 0,933 | 0,724 | 0,374 | 0,238 |
| 0,573 | 0,845 | 0,803 | 0,764 |
| 0,748 | 0,994 | 0,792 | 0,959 |
| 1,043 | 0,769 | 0,438 | 0,400 |
| 0,683 | 0,639 | 0,501 | 0,417 |
| 0,330 | 0,196 | 0,351 | 0,468 |
| 0,413 | 0,446 | 0,885 | 0,638 |
| 0,487 | 1,238 | 0,147 | -0,099 |
| 0,682 | 0,522 | 0,637 | 0,921 |
| 1,002 | 0,341 | 0,430 | 0,308 |
| 0,099 | 0,254 | 0,885 | 0,930 |
| 1,042 | 0,503 | 0,151 | 0,408 |
| 0,698 | 0,598 | 1,021 | 0,643 |
| 0,962 | 0,283 | -0,516 | -0,041 |
| 0,849 | 0,367 | 0,504 | 0,759 |
| 0,337 | 0,330 | -0,281 | 0,504 |
| 0,798 | 0,920 | 0,883 | 0,413 |
| 1,089 | 0,662 | 0,636 | 0,250 |
| 0,527 | 0,594 | -0,666 | -0,624 |
| 0,326 | 0,453 | 0,313 | 0,859 |
| 0,609 | 0,344 | 0,306 | -0,017 |
| 0,534 | -0,022 | 0,520 | -0,006 |
| 0,290 | 0,578 | -0,984 | -1,610 |
| 0,853 | 0,117 | 0,474 | 0,229 |
| 0,570 | 0,833 | 0,088 | 0,029 |
| 0,390 | 0,212 | 3,861 | 3,813 |
| 0,682 | 0,356 | 0,415 | 1,150 |
| 0,959 | 0,595 | 0,746 | 0,505 |
| 1,257 | 0,402 | 1,011 | 0,180 |
| 0,507 | 1,102 | 1,047 | 1,113 |
| 0,717 | 0,154 | -0,021 | -0,025 |
| 0,909 | 0,949 | 0,716 | 0,249 |
| 0,847 | 0,351 | 0,504 | 0,324 |
| 0,730 | 0,249 | 0,559 | 0,516 |



## Appendix 2 (additional material): Saving rates from the 1997 IMF (Callen & Thimann) study

Table 1. Household Saving Rates in OECD Countries

(In percent of disposable income, averages)

| | 1975–81 Average | | 1982–89 Average | | 1990–95 Average |
|---|---|---|---|---|---|
| 1. Italy | 24.9 | 1. Greece | 21.3 | 1. Greece | 18.3 |
| 2. Portugal | 24.4 | 2. Portugal | 21.0 | 2. Belgium | 18.2 |
| 3. Greece | 22.1 | 3. Italy | 19.8 | 3. Italy | 18.2 |
| 4. Japan | 20.4 | 4. Ireland | 15.6 | 4. Portugal | 15.7 |
| 5. Ireland | 19.7 | 5. Belgium | 15.5 | 5. France | 13.6 |
| 6. France | 18.8 | 6. Japan | 14.9 | 6. Austria | 13.3 |
| 7. Belgium | 17.9 | 7. France | 13.5 | 7. Japan | 13.0 |
| 8. Germany | 13.1 | 8. Netherlands | 12.6 | 8. Netherlands | 12.8 |
| 9. Canada | 12.7 | 9. Canada | 12.4 | 9. Germany | 12.5 |
| 10. United Kingdom | 11.5 | 10. Germany | 12.1 | 10. Switzerland | 11.7 |
| 11. Australia | 11.1 | 11. Spain | 10.8 | 11. Ireland | 11.5 |
| 12. Spain | 10.9 | 12. Austria | 10.3 | 12. Spain | 11.2 |
| 13. Austria | 10.0 | 13. United Kingdom | 9.0 | 13. United Kingdom | 10.6 |
| 14. Netherlands | 9.8 | 14. Switzerland | 7.5 | 14. Canada | 8.9 |
| 15. New Zealand | 9.5 | 15. New Zealand | 7.4 | 15. Finland | 7.0 |
| 16. Finland | 8.6 | 16. Australia | 7.3 | 16. Norway | 6.1 |
| 17. United States | 8.2 | 17. United States | 6.8 | 17. United States | 5.2 |
| 18. Norway | 5.1 | 18. Finland | 5.7 | 18. Sweden | 5.1 |
| 19. Switzerland | 4.7 | 19. Denmark | 2.3 | 19. Denmark | 4.8 |
| 20. Sweden | 4.4 | 20. Norway | 0.1 | 20. Australia | 4.3 |
| 21. Denmark | 3.0 | 21. Sweden | -0.3 | 21. New Zealand | 4.3 |

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