Determinants of Household Savings: A Cross-Country Analysis

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Abstract This paper analyses determinants of household savings in a model based on an extension of the disequilibrium savings theory. These extensions follow from the life-cycle and permanent-income theories. Based on panel data for 14 countries spanning the period 2000–2018, fixed-effect least squares and two-stage least squares estimation procedures were used. In line with previous studies, there is strong and robust evidence for the hypotheses of disequilibrium savings theory, specifically, positive effects of unanticipated income changes, unanticipated inflation and the lagged savings rate. There is also robust evidence for the income uncertainty hypothesis that uncertainty has a positive effect on savings. The analysis presents some evidence that social security suppresses savings, but finds no significant effects on the interest rate or old-age dependency ratio. Unexpectedly, the participation rate of the elderly has a significant positive effect in some specifications. These findings contribute to the debate on whether and how governments can influence saving behavior.

Keywords Household savings rate · Savings’ determinants · Social security · Panel data

JEL F31 · F32 · F36

Introduction

In many economies, households are the sector saving the most. The amount of national savings is a chief determinant of investment size in a country. Investments are an important contributing factor for future productivity and the standard of living. Hence, if a government has the well-being of its citizens, or mitigating an economic recession, as its policy objectives, it is relevant to look at the determinants of household savings.
The main contribution of this paper is to reconsider the findings for these determinants as presented by Koskela and Virén (1983). Instead of data from the 1960–70s, the current analysis is based on cross-country panel data for the period 2000 to 2018. This more recent dataset confirms some, but contradicts other previous findings. Unlike Koskela and Virén (1983), the current study finds evidence for a statistically significant negative effect of social security spending and a significant positive effect of the participation rate of the elderly on household savings.

The analysis is based on the disequilibrium savings theory presented in Deaton (1977). As individuals have incomplete information on prices, household optimal savings ratios change due to unanticipated income and inflation effects. Based on the life-cycle and permanent-income theories, the model also takes into account the interest rate, income uncertainty, social security, the old-age dependency ratio, and the participation rate of the elderly, measured as the percentage share of the population ages 65+ who are in the labor force.

The determinants of savings behavior are studied in a regression model. Using panel data from 14 Organisation for Economic Co-operation and Development (OECD) countries, the results follow from fixed-effects least-squares estimations. Additionally, to take into account potential endogeneity in an explanatory variable (the participation rate of the elderly), a two-stage least-squares procedure was used. The dependent variable of interest is the household savings ratio. The estimation results confirm the predictions of the disequilibrium savings theory. Unanticipated income, unanticipated inflation and the perceived optimal savings ratio have positive effects on the actual savings ratio. Additionally, there is robust and strong evidence supporting the income-uncertainty hypothesis. Income uncertainty has a positive effect on savings. There is no significant effect of the interest rate or the old-age dependency ratio. Finally, in contrast to what was expected, a positive significant effect of the participation rate on savings was identified in some of the analyzed specifications.

The literature on the determinants of saving behavior is so extensive, that a comprehensive survey is beyond the scope of this article. Instead, the discussion was limited to Koskela and Virén (1983). The study findings are further related to recent contributions using a comparable analytical approach (Niculescu-Aron & Mihăescu 2012; Aizenman et al. 2019; and El Mekkaoui de Freitas & Martins 2014). Koskela and Virén (1983) are revisited with more recent data as it is by far the oldest study using such an analytical approach. Koskela and Virén (1983) juxtaposed their analysis to the findings of Feldstein (1974, 1977, 1980). In the latter three contributions, Feldstein presented evidence that social security depresses savings, while Koskela and Virén did not find this. Hence, the main difference between the results of this paper and Koskela and Virén (1983) is that, when using recent data, this paper presents evidence that social security depresses savings. There is no further disagreement with the presented evidence in the mentioned literature, except that a positive effect of the participation rate of the elderly on savings was identified in some of the specifications.

The evidence in this paper is relevant to the academic debate on the potential negative effects of social security on savings. While Koskela and Virén (1983) categorically rejected such an effect, when using recent data, one of their specifications provides significant evidence of a negative effect. This paper also contributes to a policy-relevant research question. For example, Bouyon (2016) mentioned balanced economic recovery after an economic crisis and economic resilience to shocks as policy
objectives related to household savings. Weil (2009, pg. 69) additionally showed that these savings are a major determinant for national investment, and investments relate to future productivity and standards of living. According to our results, governments thus face a trade-off between household savings and social security spending. However, a significant effect of monetary policy in the form of the interest rate on household savings was not identified. In contrast, our results support precautionary motives for household savings. This implies that regulators should vigorously observe unemployment and housing price developments, as these are important determinants of household income and wealth uncertainty.

Theory and Hypotheses

In a closed economy, national investments are equal to national savings. Savings increase the national capital stock, which has a positive effect on productivity, and hence the standard of living. Due to the international mobility of capital, investments are not necessarily equal to national savings in a particular country. However, Weil (2009: pg. 69) showed that even though international investments play a role, investments in a country still significantly depend on the country’s saving rate. A government can thus increase its citizens’ standard of living or mitigate the effects of a recession through increasing national savings.¹

Koskela and Virén (1983) used the disequilibrium savings theory (Deaton 1977) as the foundation for the estimated savings function. Due to incomplete information on prices, individuals cannot distinguish relative price changes from absolute price changes. According to this theory, the actual savings ratio is determined by three terms: (i) the unanticipated income effect due to inflation; (ii) the inflation effect on savings; and (iii) the savings ratio under the assumption that the information on relative prices is correct.

While an individual has incomplete information on prices, inflation causes deviations of actual real income from anticipated real income. The individual (dis)saves this unanticipated increase (decrease) in income, and unanticipated income changes are thus expected to have a positive effect on the savings ratio. Even if an individual anticipates real income changes correctly, however, the savings ratio increases in inflation: Individuals can substitute away from more expensive products, and add the avoided expenses to their savings. This unanticipated inflation effect is predicted to be positive. Finally, the lagged savings ratio approximates the preferred saving rates under correct price information, reflecting the idea that consumers update their price information each period. Its effect on current savings is also expected to be positive. Koskela and Virén (1983) included five additional factors explaining savings behavior in their analysis: (i) the interest rate; (ii) income uncertainty; (iii) social security spending; (iv) the old-age dependency ratio; and (v) the participation rate of the elderly.

The interest rate can affect the savings ratio in two ways, due to its substitution and income effects. The substitution effect reduces the incentive to save, as it reduces returns. However, these lower returns increase savings to reach a minimum of future wealth, the so-called income effect. Typically, one would expect that the substitution

¹ This paper analyses household, i.e., private, savings. National savings also include public savings. For a study of the relationship between public and private savings, see e.g., Ruza and Montero (2003).
effect outweighs the income effect, and hence a positive effect of the interest rate on the savings ratio is expected. According to the permanent income theory (Friedman 1957), individuals use cautionary savings to compensate for income decreases, with consumption smoothing as the objective. Thus, income uncertainty was also expected to have a positive effect on the savings ratio. Following the life cycle theory (Modigliani & Brumberg 1954; Ando & Modigliani 1963), working individuals save and retirees dissave. However, social security spending can crowd out precautionary permanent-income and life-cycle savings. A pay-as-you-go social security system thus has an expected negative influence on the savings ratio. As retirees typically dissave, the dependency ratio, the share of old individuals, is also anticipated to have a negative effect. Finally, if individuals expect to generate income even after being retired, the necessity to save for retirement decreases. Hence, the participation rate of the elderly is expected to have a negative effect on the savings ratio.

Data

The objective of this paper is to gain additional insights by replicating the analysis of Koskela and Virén (1983) using recent data. Choosing OECD countries and using data from the OECD website helps to ensure reasonable homogeneity and quality of the dataset. The choice of the 14 countries is because of data availability: Selecting these countries and the time-period from 2000 to 2018 maximizes the number of observations in a balanced panel. Avoiding an unbalanced panel helps to reduce the risk of biased estimates (Baltagi & Song 2006). The descriptive statistics for the data are in Table 1.

The dependent variable of interest is household savings behavior. The analysis uses the savings rate, i.e., the ratio of household’s savings and disposable income of a country, as an approximation for savings. The rate is expressed as a percentage of disposable income. Savings are household net disposable income plus the adjustment for the change in pension entitlements (like mandatory pension savings) less final consumption expenditures (OECD 2020a).

For the explanatory variables, the following data are used. Household disposable income, measured in United States’ dollars (USD), consists of wages, salaries, self-employed income, social benefits, net interest and dividends received, less the payment of taxes and social contributions, and depreciation costs (OECD 2020b). The private final consumption-expenditure deflator index, with different reference years for each country, is from OECD (2020c). The interest rate (OECD 2020d) is based on the interest rates of government bonds maturing in ten years. OECD (2020e) provides the unemployment rates, defined as the people of working age (15–64 years old) who are without work, are available for work, and have taken specific steps to find work as a percentage of the labor force. The social benefits to households as a percentage share of gross domestic product (GDP) approximate social security spending (OECD 2020f). The old-age dependency ratio is measured as the ratio of the population 65+ to the population 15–64 (OECD 2020g). Finally, the participation rate of the population over

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2 Austria, Belgium, Canada, Germany, Denmark, Spain, Finland, the United Kingdom, Hungary, Ireland, Italy, Norway, Sweden, and the United States of America.
age 65, i.e., the percentage share of individuals age 65+ in the labor force as a percentage of all individuals over 65, is from OECD (2020h).

Table 2 contains the correlation matrix. Pairwise correlations of the regressors can be used as a rule-of-thumb indication for the existence of a potential multicollinearity problem. The correlations suggest (using ± 0.5 as a cut-off) the following possible multicollinearity problems: income-deflator, income-interest, deflator-interest, and security-dependency. However, income and deflation are only used in the first- or the second-difference form, eliminating the first three latent multicollinearity problems. The only remaining potential multicollinearity problem would then be between social security spending and the old-age dependency ratio.

Methodology

Four different specifications are used to study household savings behavior. The first two specifications distinguish between constant and static expectation hypotheses, respectively. The regression model in Eq. (1) uses the constant expectation hypotheses for the rates of change of real income and inflation.

\[
\frac{\Delta y}{y} = \beta_1 \Delta \log Y_{it} + \beta_2 \Delta \log P_{it} + \beta_3 \left( \frac{S}{y} \right)_{t-1} + \beta_4 R_{it} + \beta_5 \Delta U_{it} + \beta_6 \Delta S_{it}
\]

\[
+ \beta_7 \Delta L_{it} + \beta_8 PR_{it} + \sum_{j=1}^{14} d_j D_j + u_{1,it} \quad (1)
\]

The dependent variable, \( \frac{S}{y} \), denotes (net) household savings for country \( i \) in year \( t \) (OECD 2020a). As explanatory variables, \( \Delta \log Y_{it} \) is the unanticipated income growth, i.e., the first difference of the log of income from OECD (2020b). The private final consumption-expenditure deflator index (OECD 2020c) is used to derive

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Table 1 Descriptive Statistics for the Dependent and Explanatory Variables

|                                | Mean  | Median | St.Dev. | Min.  | Max.  |
|--------------------------------|-------|--------|---------|-------|-------|
| Household savings rate (dependent variable, in % of disposable income) | 0.055 | 0.053  | 0.038   | −0.056| 0.137 |
| Disposable income (in USD per capita)       | 27,336| 27,095 | 7103    | 9399  | 53,122|
| Expenditure deflator index (national reference year) | 0.910 | 0.919  | 0.103   | 0.529 | 1.130 |
| Interest rate (in % per annum)             | 3.592 | 3.795  | 1.825   | 0.091 | 9.601 |
| Unemployment rate (in % of total labor force) | 0.074 | 0.069  | 0.035   | 0.025 | 0.261 |
| Social security spending (in % of GDP)     | 0.144 | 0.147  | 0.030   | 0.071 | 0.201 |
| Old-age dependency ratio (ratio of 65+ to 15–64) | 0.251 | 0.249  | 0.042   | 0.156 | 0.354 |
| Participation rate 65+                    | 0.073 | 0.061  | 0.048   | 0.012 | 0.195 |

Note: Number of observations: 266 for each variable from the years 2000–2018. Source: Own calculations using data from OECD (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h)

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\(^3\) We are grateful to anonymous reviewers for the suggestion to include this correlation matrix.
### Table 2  Correlation Matrix of the Dependent and Explanatory Variables

|                      | Disposable income | Expenditure deflator index | Interest rate | Unemployment rate | Social security spending | Old-age dependency ratio | Participation rate 65+ |
|----------------------|-------------------|----------------------------|---------------|-------------------|--------------------------|--------------------------|------------------------|
| Household savings rate (dependent variable, in % of disposable income) | 0.217             | −0.158                     | −0.056        | −0.042            | 0.171                    | 0.216                    | −0.022                 |
| Disposable income (in USD per capita)                                   | 0.610             | −0.712                     | −0.212        | 0.134             | 0.218                    | 0.593                    |
| Expenditure deflator index (national reference year)                    |                   | −0.724                     | 0.185         | 0.194             | 0.351                    | 0.208                    |
| Interest rate (in % per annum)                                          | 0.082             | −0.146                     | −0.464        | −0.316            |                          |                          |
| Unemployment rate (in % of total labor force)                           |                   |                            | 0.181         | 0.135             | −0.340                   |                          |
| Social security spending (in % of GDP)                                  |                   |                            | 0.641         | −0.346            |                          |                          |
| Old-age dependency ratio (ratio of 65+ to 15–64)                         |                   |                            |               |                   |                          | −0.220                   |

Note: Number of observations: 266 for each variable from the years 2000–2018. Source: Own calculations using data from OECD (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h).
unanticipated inflation, $\Delta \log P_{it}$, is the first difference of the log of the implicit expenditure deflator. $R_{it}$ is the real rate of interest, approximated by the nominal interest rate (OECD 2020d). The proxy for income uncertainty is $\Delta U_{it}$, the first difference of the unemployment rate (OECD 2020e). $SS_{it}$ is social security benefits relative to GDP (OECD 2020f), $OLD_{it}$ is the old-age dependency ratio (OECD 2020g), and $PR_{it}$ is the participation rate of people over age 65 (OECD 2020h). $D_j$ denotes country-specific dummies: 1 for country $j = i$, and 0 otherwise. The regression model in Eq. (2) uses the static expectation hypothesis for the rates of change of real income and inflation.

$$\left(\frac{s}{y}\right)_{it} = \beta_1 \Delta \log Y_{it} + \beta_2 \Delta \log P_{it} + \beta_3 \left(\frac{s}{y}\right)_{t-1} + \beta_4 R^*_{it} + \beta_5 \Delta U_{it} + \beta_6 SS_{it}$$

$$+ \beta_7 OLD_{it} + \beta_8 PR_{it} + \sum_{j=1}^{14} d_j D_j + u_{2, it}$$

(2)

The variables are the same as in Eq. (1), except for the explanatory variables $\Delta \Delta \log Y_{it}$, unanticipated income growth (now the second difference of the log of income (OECD 2020b)), unanticipated inflation $\Delta \Delta \log P_{it}$ (now the second difference of the log of the implicit expenditure deflator), and $R^*_{it}$, the real interest rate (now the nominal rate (OECD 2020d) minus the lagged inflation rate). The expenditure deflator and the inflation rate are based on OECD (2020c).

The other specifications take into consideration the potential dependency of the participation rate of the elderly on social security spending. The participation rate can be affected by an induced retirement effect of social security on household savings, counteracting the asset substitution effect. To capture the potential simultaneity between household savings, $\left(\frac{s}{y}\right)_{it, t-1}$ and the participation rate, $PR_{it}$, in Eq. (1), first, the following regression equation is estimated for $PR_{it}$:

$$PR_{it} = a_1 OLD_{it} + a_2 SS_{it} + a_3 U_{i,t-1} + a_4 PR_{i,t-1} + \sum_{i=1}^{14} c_j D_j + v_{it}$$

(3)

where $U_{i, t-1}$ is the lagged unemployment rate from OECD (2020e), capturing potential discouragement effects of unemployment on participation. $PR_{i, t-1}$ is the lagged participation rate (OECD 2020h), and the other variables are as described earlier. The predicted values $\hat{PR}_{it}$ are retained from this regression. In the second step, the regression models Eq. (4) and Eq. (5) are estimated using $\hat{PR}_{it}$ from Eq. (3):

$$\left(\frac{s}{y}\right)_{it} = \beta_1 \Delta \log Y_{it} + \beta_2 \Delta \log P_{it} + \beta_3 \left(\frac{s}{y}\right)_{t-1} + \beta_4 R^*_{it} + \beta_5 \Delta U_{it} + \beta_6 SS_{it}$$

$$+ \beta_7 OLD_{it} + \beta_8 \hat{PR}_{it} + \sum_{j=1}^{14} d_j D_j + u_{4, it}$$

(4)

and

$$\left(\frac{s}{y}\right)_{it} = \beta_1 \Delta \log Y_{it} + \beta_2 \Delta \log P_{it} + \beta_3 \left(\frac{s}{y}\right)_{t-1} + \beta_4 R^*_{it} + \beta_5 \Delta U_{it} + \beta_6 SS_{it}$$

$$+ \beta_7 OLD_{it} + \beta_8 \hat{PR}_{it} + \sum_{j=1}^{14} d_j D_j + u_{5, it}$$

(5)
with the variables as described earlier.

Note that the specifications follow Koskela and Virén (1983). The specifications include individual intercepts for each country and, thus, consider cross-country differences. The regression models are estimated using ordinary least squares (OLS). The inclusion of country-specific dummies made the models so-called fixed effect regression models (FEM), while the two-step procedure used for estimating Eq. (4) and Eq. (5) is known as a two-stage least-squares (2SLS) estimation procedure.

Regression Results

Table 3 presents the regression results for the specifications in Eqs. 1 and 2. In both specifications, the estimated parameters are jointly highly significant (all $R^2$’s were well above 0.8; hence the $p$-values of the not reported, respective $F$-tests of joint significance were well below 1%). However, the old-age dependency ratio is insignificant in both and social security is only significant in the second specification. This could relate to the potential multicollinearity problem previously mentioned. To address this problem, the estimates of Eqs. 1 and 2 are repeated, subsequently leaving out one of these two variables. Table 4 shows that social security is now significant in both specifications. Yet, the old-age dependency ratio remains insignificant, ruling out multicollinearity as the explanation for the lack of significance. Table 5 presents the estimation results when addressing the possible simultaneity between the savings- and participation rate. The parameters in the first-stage regression Eq. (3) are jointly highly significant, substantiating the indirect specifications Eqs. 4 and 5.

The expected signs, based on the theory discussion, and the estimated signs with significance levels are in Table 6. For comparison purposes, Table 6 also presents the findings of Koskela and Virén (1983), together with three other more recent related studies that used a comparable analytical approach. According to the disequilibrium savings hypotheses, unanticipated income changes, unanticipated inflation and the lagged saving rates should have a positive effect on savings. In line with Koskela and Virén (1983), our analysis presents robust and highly significant evidence supporting the predictions of the disequilibrium savings hypothesis. The estimated sizes of these effects are, moreover, of the same order. Income uncertainty also has a consistent and strongly significant positive effect on savings, in line with the uncertainty hypothesis and the size and direction reported in Koskela and Virén (1983). Again, the interest-rate effect on savings is insignificant. Social security has a negative effect on the saving rates, an effect that is statistically significant for three of the four specifications. It implies that a pay-as-you-go system could decrease total savings. This significant effect is in line with the findings by Feldstein (1974, 1977, 1980), but criticized in Koskela and Virén (1983) who did not find significant effects in any of their three specifications. The old-age dependency ratio had no significant effect in our analysis or in Koskela and Virén (1983). Contradicting the expected negative effect and in contrast with the insignificant effects in Koskela and Virén

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4 Note that due to first-order (e.g., in Eq. (1)) and second-order (e.g., in Eq. (2)) differencing, the number of observations in Table 3 and subsequent tables can differ per specification.
Table 3  Determinants of Saving Behavior: OLS FEM Regression Results

| Variables                                      | Dependent | Explanatory |
|-----------------------------------------------|-----------|-------------|
| Saving ratio (s/y)                            |           |             |
| Unanticipated income change                  | 0.504***  | 0.250***    |
| (Δ\log Y) or (ΔΔ\log Y)                      | (0.102)   | (0.068)     |
| Unanticipated inflation                       | 0.889***  | 0.750***    |
| (Δ\log P) or (ΔΔ\log P)                      | (0.223)   | (0.209)     |
| Lagged saving rate                            | 0.730***  | 0.760***    |
| (s/y)                                         | (0.044)   | (0.046)     |
| Interest rate                                 | 0.013     | 0.142       |
| (R) or (R*)                                   | (0.118)   | (0.094)     |
| First difference Unemployment                 | 0.005***  | 0.004***    |
| (ΔU)                                          | (0.001)   | (0.001)     |
| Social security                               | −0.129    | −0.220**    |
| (SS)                                          | (0.092)   | (0.093)     |
| Old-age dependency ratio                      | −0.080    | 0.088       |
| (OLD)                                         | (0.092)   | (0.082)     |
| Participation rate                            | 0.149*    | 0.094       |
| (PR)                                          | (0.078)   | (0.082)     |
| Austria                                       | 0.062**   | 0.034*      |
| (0.024)                                       | (0.019)   |             |
| Belgium                                       | 0.061**   | 0.026       |
| (0.025)                                       | (0.019)   |             |
| Canada                                        | 0.018     | −0.005      |
| (0.019)                                       | (0.013)   |             |
| Germany                                       | 0.065**   | 0.029       |
| (0.027)                                       | (0.020)   |             |
| Denmark                                       | 0.035     | 0.009       |
| (0.023)                                       | (0.017)   |             |
| Spain                                         | 0.044*    | 0.009       |
| (0.024)                                       | (0.018)   |             |
| Finland                                       | 0.030     | 0.004       |
| (0.024)                                       | (0.018)   |             |
| United Kingdom                                | 0.033     | 0.003       |
| (0.023)                                       | (0.016)   |             |
| Hungary                                       | 0.054**   | 0.016       |
| (0.025)                                       | (0.017)   |             |
| Ireland                                       | 0.027     | 0.008       |
| (0.017)                                       | (0.012)   |             |
| Italy                                         | 0.057**   | 0.015       |
| (0.029)                                       | (0.022)   |             |
| Norway                                        | 0.031     | 0.010       |
| (0.022)                                       | (0.015)   |             |
| Sweden                                        | 0.048*    | 0.017       |
| (0.024)                                       | (0.017)   |             |
| United States                                 | 0.025     | 0.010       |
| (0.020)                                       | (0.015)   |             |
| Observations                                  | 252       | 238         |
(1983), the participation rate had a positive and significant effect in three of the four specifications.

As additional robustness checks, the impact of financial and sovereign crises was considered followed by the impact of Brexit on household savings habits. The regression results of both checks are presented first before their interpretation. To analyze the impact of the crises, two dummy variables were constructed. The first, financial crisis, equals 1 for all countries for the years 2008 and 2009 and 0 otherwise. The second,

| Table 3 | Determinants of Saving Behavior – Multicollinearity: OLS FEM Regression Results |
|---------|-----------------------------------------------------------------------------|
| Variables | [1 without SS] | [1 without OLD] | [2 without SS] | [2 without OLD] |
| Dependent Explanatory | Saving ratio (s/y) | Saving ratio (s/y) | Saving ratio (s/y) | Saving ratio (s/y) |
| R² | 0.847 | 0.850 |
| Notes: Standard errors are in parenthesis. *** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level. Model [1] is based on data from 2001 to 2018 and model [2] on data from 2002 to 2018. Source: Own calculations using data from OECD (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h) |

| Table 4 | Determinants of Saving Behavior – Multicollinearity: OLS FEM Regression Results |
|---------|-----------------------------------------------------------------------------|
| Variables | [1 without SS] | [1 without OLD] | [2 without SS] | [2 without OLD] |
| Dependent Explanatory | Saving ratio (s/y) | Saving ratio (s/y) | Saving ratio (s/y) | Saving ratio (s/y) |
| Unanticipated income change | 0.550*** (0.097) | 0.488*** (0.100) | 0.259*** (0.069) | 0.260*** (0.068) |
| (Δlog Y) or (ΔΔlog Y) | | | | |
| Unanticipated inflation | 0.799*** (0.214) | 0.883*** (0.223) | 0.829*** (0.209) | 0.797*** (0.205) |
| (Δlog P) or (ΔΔlog P) | | | | |
| Lagged saving rate | 0.740*** (0.043) | 0.728*** (0.043) | 0.772*** (0.046) | 0.764*** (0.046) |
| (s/y) | | | | |
| Interest rate | −0.038 (0.112) | 0.077 (0.092) | 0.045 (0.085) | 0.096 (0.084) |
| (R) or (R*) | | | | |
| First difference Unemployment | 0.005*** (0.001) | 0.005*** (0.001) | 0.003*** (0.001) | 0.003*** (0.001) |
| (ΔU) | | | | |
| Social security | −0.164** (0.083) | −0.164** (0.083) | −0.168** (0.080) | −0.168** (0.080) |
| (SS) | | | | |
| Old-age dependency ratio | −0.136 (0.083) | −0.011 (0.071) | | |
| (OLD) | | | | |
| Participation rate | 0.158** (0.078) | 0.120* (0.070) | 0.112 (0.071) | 0.143** (0.068) |
| (PR) | | | | |
| Observations | 252 | 252 | 238 | 238 |
| Notes: Standard errors are in parenthesis. *** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level. SS: Social security; OLD: Old-age dependency ratio; OLS FEM: Ordinary least squares fixed effects model. Estimates include country dummies. Model [1] is based on data from 2001 to 2018 and model [2] is based on 2002–2018. Source: Own calculations using data from OECD (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h). Estimates of country dummies are available upon request. |
To analyze the impact of Brexit, a Brexit dummy variable is constructed. The dummy, \textit{Brexit}, equals 1 only for the United Kingdom for 2016 (the year of the Brexit referendum) and the years after, and equals 0 otherwise. The regression results are in Table 8.6.

Note that the estimated coefficients of the original determinants of saving behavior remain of the same order of magnitude and significance (compare Tables 3, 7 and 8), proving the results’ robustness to alternative specifications. The financial crisis had a

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5 A more detailed table with, e.g., the estimated country dummies, is available upon request. The findings are robust to how the dummy variables are constructed. For example, one could argue that the financial crisis started midway through 2007. Changing the 0 for 2007 into a \( \frac{1}{2} \) for all countries did not qualitatively change the results. Alternatively, the sovereign-debt crisis can be seen as a European crisis. Limiting the 1 for the sovereign-debt dummy to the European (or even the European Union) countries again did not change the results qualitatively.

6 A more detailed table with, e.g., the estimated country dummies, is available upon request. This dummy was changed in several ways, for example by having 1 for the United Kingdom and Ireland (the country arguably most affected by Brexit) for 2016 and the years after, and 0 otherwise. No qualitative differences were identified in the negative effect on savings of Brexit with these different dummies.
Table 6  Comparison of Hypotheses, Own Regression Outcomes and Related Studies

| Expected Effects | Own Results | Koskela & Virén (1983) | Other Related Studies |
|------------------|-------------|-------------------------|-----------------------|
|                  | [1]         | [2] [4] [5]             | [1] [2] [4] [NM] [ACI] [EM] |
| Unanticipated income change (Δlog Y) or (ΔΔlog Y) | + | +*** +*** +*** +*** | +*** +*** +*** +*** |
| Unanticipated inflation (Δlog P) or (ΔΔlog P) | + | +*** +*** +*** +*** | +*** +*** +*** +*** |
| Lagged saving rate (s/y) | + | +*** +*** +*** +*** | +*** +*** +*** +*** |
| Interest rate (R) or (R∗) | + | + | + | + | +*** + | +*** |
| Income uncertainty (ΔU) | + | +*** +*** +*** +*** | +*** +* +*** | −/− |
| Social security (SS) | − | −* −* −* −* | −* −* −* |
| Old-age dependency ratio (OLD) | − | − | + | − | − | −/+ − |
| Participation rate (PR) or (PR) | − | +* + +*** + | − | − |

Notes: *** Significant at the 1% level **: Significant at the 5% level; *: Significant at the 10% level. Sources: Expected effects as in Koskela and Virén (1983); Own results based on calculations, presented in Tables 3, 4 and 5, using data from OECD (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h); Koskela and Virén (1983, Table 1); [NM]: Niculescu-Aron and Mihăescu (2012); [ACI]: Aizenman et al. (2019) -using output volatility as a proxy for income uncertainty-; [EM]: El Mekkaoui de Freitas and Martins (2014)

Table 7  Determinants of Saving Behavior - financial & sovereign-debt crises: OLS FEM Regression Results

| Variables | [1] Saving ratio | [2] Saving ratio |
|-----------|-----------------|-----------------|
| Dependent Explanatory |          |                  |
| Unanticipated income change | 0.531*** | 0.287*** |
| Unanticipated inflation | 0.845*** | 0.631*** |
| Lagged saving rate | 0.748*** | 0.783*** |
| Interest rate | −0.022 | 0.123 |
| First-diff. / lagged unemployment | 0.003*** | 0.002*** |
| Social security | −0.089 | −0.168* |
| Old-age dependency ratio | −0.083 | 0.086 |
| Participation rate 65+ | 0.128 | 0.075 |
| Financial crisis | 0.009** | 0.008** |
| Sovereign-debt crisis | −0.000 | −0.003 |

Notes: Standard errors are in parenthesis. *** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level. Estimates include country dummies. OLS FEM: Ordinary least squares fixed effects model. Model [1] is based on data from 2001 to 2018, model [2] is based on 2002–2018. Source: Own calculations using data from OECD (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h).
significant positive effect on savings in all three specifications, while the sovereign-debt crisis did not. The positive effect of the financial crisis on savings is consistent with precautionary savings motives (e.g., Mody et al. 2012). Brexit had a significant negative effect on savings in all three specifications, in line with several academic, monetary-policy, and newspaper contributions (e.g., Perraton & Spreafico 2019; Bank of England 2019; Guardian 2017). This provides further evidence for the robustness of the results.

### Concluding Remarks

This paper studies the determinants of household savings, based on a panel of OECD countries. Most of the results presented in Koskela and Virén (1983), using data from the 1960s and 70s, also hold for the analysis of data from 2000 to 2018. Specifically, the disequilibrium-savings and income-uncertainty hypotheses get strong support in the analyses of both data sets. However, an important contrast is that a negative and significant effect of social security spending on the savings ratio is identified in one of our specifications. This result is in line with Feldstein (1974, 1977, 1980), a result criticized by Koskela and Virén (1983). The other contrast with the latter analysis is the significant and counterintuitively positive effect of the participation rate of the elderly on savings.

Our findings are also compared with those in studies that are more recent. When included, the predictions of the disequilibrium savings hypotheses were also supported in the analyses of Niculescu-Aron and Mihăescu (2012), Aizenman et al. (2019), and El Mekkaoui de Freitas and Martins (2014). Contrary to the other contributions, Niculescu-Aron and Mihăescu (2012), and El Mekkaoui de Freitas and Martins

| Variables                  | [1] Saving ratio | [2] Saving ratio |
|----------------------------|------------------|------------------|
| Unanticipated income change| 0.510***         | 0.251***         |
| Unanticipated inflation    | 0.863***         | 0.725***         |
| Lagged saving rate         | 0.722***         | 0.750***         |
| Interest rate              | −0.003           | 0.136            |
| First-diff. / lagged unemployment | 0.005***  | 0.004***         |
| Social security            | −0.129           | −0.224**         |
| Old-age dependency ratio   | −0.078           | 0.096            |
| Participation rate 65+     | 0.163**          | 0.105            |
| Brexit                     | −0.023**         | −0.020**         |

Notes: Standard errors are in parenthesis. *** Significant at the 1% level ** Significant at the 5% level * Significant at the 10% level. Estimates include country dummies. OLS FEM: Ordinary least squares fixed effects model. Model [1] is based on data from 2001 to 2018, model [2] is based on 2002–2018. Source: Own calculations using data from OECD (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g, 2020h).
(2014) both found a statistically significant effect of the interest rate on saving ratios, while El Mekkaoui de Freitas and Martins (2014) is the only analysis that found a significant (and, as expected, negative) effect of the old-age dependency ratio on savings.

The presented positive relationship between the participation rate and savings deserves further research. A potential way of explaining this is to include health in the analysis. Health and income are positively related (e.g., Backlund et al. 1996; McDonough et al. 1997; Deaton & Paxson 1998; Case et al. 2002; Zimmer & House 2003; Schmeiser 2009). However, there is no consensus on the direction of causality. Higher income may cause improvements in health (e.g., Case et al. 2002; Lindahl 2005; Amo et al. 2009), lower income may be due to poor health (e.g., Bound 1989; Haveman et al. 1995; Smith 1999, 2004), while others (e.g., Fuchs 1982) suggest that other factors, like a high discount rate, is causing both low income and poor health. Nevertheless, high-income individuals tend to save more (e.g., Keynes 1936; Carroll et al. 2017) and are more likely to be healthy enough to be able to work at an advanced age, for example to benefit from a higher level of life satisfaction when working as retirees (e.g., Dingemans & Henkens 2019). However, the exploration of this is beyond the scope of this contribution, which is to evaluate Koskela and Virén (1983) using a dataset that is three decades newer.

Another way to extend the research is by taking into account the effects of monetary policy. According to Brandao-Marques et al. (2021), for example, there are no empirical studies focusing on the effects of negative interests on household saving decisions. Additionally, there is no consensus on how other unconventional monetary policies, like quantitative easing, affect savings. The same holds for the effects of a possible break-up of a currency peg or union.

One of the current policy concerns about low interest rates is that it may suppress saving, therefore investment and consequently future labor productivity and standards of living. In our results, there is no significant effect of interest rates on the saving ratios. However, one should note that the sample does not include a period of several years of persistently low or even negative interest rates. Such periods might deteriorate balance sheets of financial institutions in the medium- or long-run (e.g., Aizenman et al. 2017). This monetary policy can also influence low income-countries differently than the middle- and high-income countries in the studied sample (e.g., Aizenman et al. 2016). These are just two ways that prolonged low (negative) interest rates can non-linearly affect savings and living standards. In contrast with some related studies, security spending potentially decreases the savings ratio, thus potentially affecting savings decisions.

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7 Kim and Kim (2006), for example, found a long-run linkage, but no short-run causality between savings and medical expenditures (which can be seen as a proxy for health).
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