
The Level of Economic Development and the Savings Rate of Households

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Abstract:

Purpose: The aim of this article was to present the G7 household savings rate models, including the extraction and identification of time series components that determine the formation of the studied phenomenon.

Design/Methodology/Approach: The research was carried by a detailed analysis of the savings rates of G7 households in individual quarters in the years 2000-2018. Time series decomposition and identification of time series components, including the seasonal component, trend and outliers were made using econometric tools. The analyses used the automatic seasonal adjustment procedures TRAMO-SEATS and ARIMA-X-12. The obtained models were formally verified empirically.

Findings: The decomposition of the time series of the G7 household savings rate provided information on the shaping of the analysed phenomenon. Using the Tramo-Seats procedure, it was shown that the savings rate of the United States, Canada and France is not subject to seasonal fluctuations, and the visible fluctuations are the result of the moving average process and outliers. Seasonal savings occurred in the case of Japan, Germany, Italy, and Great Britain. This seasonality was of a different nature, with the largest seasonal deviations recorded for Germany and Italy.

Practical implications: In this paper the components of the time series of savings rates of G7 households were analysed and distinguished, showing differences in the development of the analysed phenomenon in individual countries, providing the appropriate economic justification for the differences.

Originality/Value: In macroeconomic scale, households play an important role in the economy, creating the conditions for the sustainable development of the economy. They are an important source of financing for business investment and budget deficits. In a microeconomic perspective, a low savings rate can reduce the living conditions of the population, which has many negative effects. Taking this into account the above, learning about the development of the phenomenon under study, which is the household savings rate, allows to predict and adjust economic programs to optimize the desired effects.

Keywords: Savings rate, households, TRAMO-SEATS procedure.

JEL Code: C10, D12, D14, D31, C38.

Paper type: Research paper.

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1. Introduction

The relationship between the level of economic development and the household saving rate has been demonstrated by many authors (Modigliani, 1988; Carroll and Weil, 1993; Carroll, Overland, and Weil, 2000; Mohan, 2006). Harrod (1939) and Domar (1946) were one of the precursors in this regard. The authors pointed to the relationship between the level of economic development and the level of savings in Harrod's formulation-Domar growth model, which was the basis of another theoretical model - Solowa (1956). It highlights the role of savings rates in the context of changes in national income. It is formulated that the higher the savings rate, the higher the level of investment and subsequently a higher level of economic development. G7 economies therefore have favourable economic conditions, a sufficient level of income to achieve high savings rates.

The available literature on the level of household savings rate provides a range of information considering macroeconomic and microeconomic conditions for savings. The behaviour of households regarding saving is important in view of the role played by the household in every economy. The main assumptions concerning the level of savings were formulated by Keynes (2003). In his works, he demonstrated the existence of a proportional relationship between the income received by units of management and the level of savings (Grzywińska-Rapca, 2017). A defined proportionality between the income of households and their savings provided the basis for further studies and theories. Those studies were mainly focused on identifying the relationship between the level of savings and economic factors (the rate of income growth per capita, the rate of employment growth and the rate of increase in disposable income of households) (Table1).

Table 1. Selected studies on household savings

Author	Explained variable	Explanatory variable	Outcome	Years of study/ publication
Modigliani	Private savings rate	per capita income growth	+	1970 World (36 countries)
			+	1970 World (24 countries)
		Product growth rate per person employed	+	1970 World (24 countries)
		Employment growth rate	+	1970 World (24 countries)
Edwards	Private savings	Per capita income growth	+	1996 (36 countries)
Schmidt — Hebbel, Webb, Corsetti	Household saving from disposable income	Disposable income of households' growth rate	+	1992 (10 countries)

Source: Own work based on Liberda and Tokarski, 2000.

Ando and Modigliani (1963) made an important contribution to the literature on issues related to the level of household savings. According to the life cycle theory (Ando and Modigliani, 1963), financial behaviour depends on the household's life stage. This was also emphasised in studies by Baldini and Mazzaferro, (2000). Those authors identified the low flexibility of savings ratio towards ageing. They also put forward the hypothesis that this was inconsistent with empirical evidence and with the predictions of the life cycle hypothesis. According to Baldini and Mazzaferro (2000), a demographic change results in a decrease in the savings rate. This means that people in the last phase of the life cycle have less savings than in previous life cycle phases.

According to Mueller and Lean (1967), and Katona (1975), savings are determined by the current consumption. This may mean that many households do not save in order to secure their old age, but they accumulate funds for short-term consumption purposes. Therefore, they often withdraw the accumulated savings to make planned purchases. In rich countries and societies, inheritance plays an important role. Empirical studies in such countries such as the USA and the UK have shown that inheritance can range from 20% to 25% of the total life assets of an individual (Modigliani, 1988). In turn, many empirical studies confirm a link between savings and interest rates. According to Juster and Taylor (1975), Boyle and Murray (1979), this relation is not always positive (Weber 1975). Weber also proved in his research that a higher interest rate reduces savings if the wealth resulting from the possession of durable goods is taken into account. In the past, the research examining the propensity to consume and save paid close attention to economic factors, also known as objective factors, since they refer to the state of the environment in which households function and make decisions on this issue. According to Keynes, the following macroeconomic factors can be identified (Table 2).

Table 2. *Macroeconomic factors determining the propensity of households to save*

Inflation	Damaging impact on the generation of savings.
	It is not worth saving to purchase goods because due to inflation, people have to save more than the value of the goods in question.
Taxes	Taxes largely reduce disposable income, often to such a level that households struggle to cover autonomous consumption, which adversely affects savings.
	It is a common knowledge that the lower the disposable income, the lower the propensity to save.
Amount of income	The propensity to save is determined by the amount of disposable income.
	Slow economic growth, high taxes, and social security burden, falling interest rates and high unemployment may limit the amount of disposable income.
Exchange rate	Low frequency of exchange rate fluctuations ensures that the value of the money held will not rapidly change, thus helping to generate savings by households.

Source: Own work based on Lunt, Livingstone, 1991; Grigoli, Herman and Schmidt-Hebbel, 2014; Maciejasz-Świątkiewicz, Palmer, 2009.

In addition to macroeconomic factors determining the savings rate of households listed in Table 2, monetary stability, interest rate and the level of capital market development in the given economy should be mentioned. Monetary stability is important in the context of household savings because of its impact on the rate of financial resource circulation in the economy. The slower is the flow, the higher is the propensity of the households to save. A fast flow due to, e.g., the outflow of funds abroad, is unfavourable in the long term. The interest rate is particularly important for high-income households. This group of households demonstrates a higher propensity for long-term saving in comparison to low-income households (third and higher quartile).

The level of the capital market development, on the other hand, allows households to allocate financial surpluses in a more efficient manner. The above listed macroeconomic factors are interlinked. A change to one of them involves a change of another. Inflation reduces the current savings of households, which results in fewer deposits due to lower interest rates, followed by impeded expansion of the capital market as no savings are placed on this market. In the context of economic slowdown (following the crisis of 2009-2009), the generation of household savings (domestic savings) is of crucial importance for the economic recovery of every country.

Therefore, for instance, the G20 decided to track savings at the global level by using a set of economic indicators, including savings rates, public debt, and current account deficit (Callen and Thiman, 1997). The level of domestic savings of households allows for the implementation of financial policies stimulating savings, which is important for anti-crisis and economic recovery programmes (Denizer and Holger, 2000). Changes to the household savings rate can be therefore conditioned by various factors. According to Bartzsch (2006), households with higher income insecurity (measured as a change in income) show a higher propensity to save. Therefore, an increasing savings rate could reflect a significant increase in unemployment. The increase in the savings rate may be caused by the introduction of new subsidies and fiscal incentives for private pensions (the so-called Riesterreente in Germany).

The socio-demographic and cultural factors should be mentioned as important factors for determining the saving behaviour of households (Grzywińska-Rapca, 2016). According to Lea, Torpy and Webley, savings-related attitudes and behaviours can be influenced by the membership in a social or ethnic group, race, religion, or place of residence (Lea, Torpy, and Webley 1987). The link between the social position and the propensity to save was also emphasized by Lindqvist in his studies, demonstrating that the propensity to save is determined by the social position (Lindqvist 1981). In the context of the differentiation in the level of savings in the G7 countries, cultural behaviours may be of crucial importance, and they are regarded as subjective factors.

However, if in each culture the fact of having savings is considered a value, then regardless of the income earned, there is a division into consumption and saving at the moment of the acquisition of funds, and not after satisfying consumption needs. In a different economy, in which a culturally different system is in place, consumption will always take precedence over saving. Cultural factors include education, which helps to increase the awareness of households, potentially leading to an increase in the household savings rate. Leetmaa, Rennie, and Thiry (2009) list the following main factors contributing to the dissimilarities between different types of economies:

- The income effect – higher income leads to higher savings;
- The asset effect – profits/losses on financial and non-financial assets and liabilities have an impact on the accumulated assets and thus probably on expenditure but not on income. Higher wealth can then lower the savings rate;
- Credits – in the countries (e.g., the UK and the USA) where consumer credit is easier to finance, savings rates may be relatively lower;
- Institutional factors – e.g., differences in social security systems;
- Subjective factors – households' expectations concerning the future economic situation;
- Cultural and social factors.

2. Data Sources

The data on the savings rate in the G7 countries are derived from the records collected by national statistical offices, U.S. Bureau of Economic Analysis, Statistics Bureau of Japan, Deutsche Bundesbank, National Institute of Statistics, Statistics Canada, French National Institute of Statistics and Economic Studies and Office of National Statistics. The analysis used quarterly data. For countries for which the saving rate is presented monthly, the data were transformed using an average of the three months of the quarter in question. The study uses data from the period starting in the first quarter of 2000 and ending in the first quarter of 2018.

3. Research Methods

The changes in the G7 savings rate were examined using the TRAMO-SEATS procedure. The procedure was developed by Maravell and Gomez in 1996 and it uses the seasonal compensation of the time series based on the ARIMA model. The procedure consists of the following parts, TRAMO and SEATS. The TRAMO procedure (Time Series Regression with ARIMA Noise, Missing Observations and Outliers) performs estimation and forecasting of the model, regardless of the residual profile. The SEATS procedure (Signal Extraction in ARIMA Time Series) decomposes a series described with the ARIMA model into a trend-cycle, a seasonal factor, a transitional component, and an irregular component. The seasonal factor is identified using the Friedman test, the Kruskal-Wallis test, the moving seasonality test, the identifiable seasonality test, or the complex seasonality test (Hamulczuk,

2011). Calendar effects, such as the Easter effect and the Working Days effect, are also identified. The calendar effect is the effect of working days and movable holidays. The working day effect is understood as the effect of a different number of working days in individual periods (months, quarters) on the observed phenomenon (Barton, Al.-Sarray, Chretien, and Jagan, 2018). Business activity of economic operators is more intense on working days than on public holidays (Olejarcz-Wahba and Rutkowska-Ziarko, 2015). The effect of holidays, particularly the Easter and Christmas effects, concerns economic activity during the holiday period. What is important in such a case is the date on which a holiday falls and the number of working days in each pre-holiday period. The effect of non-movable holidays is not considered separately in methods of seasonal smoothing of time series, as non-movable holidays are taken into account in the working day effect (Lian, Huang, and McElroy, 2018).

The TRAMO-SEATS method, in addition to identifying seasonality and calendar effects, also allows for the automatic detection of outliers in the form of long-term changes (LS–level shift), one-off changes, shocks (AO–additive outliers) and temporary changes (TC), which is particularly useful for analysing phenomena depending on changes, for instance in legislation (Gutkowska and Paśnicka, 2007).

There are many methods for seasonal data equalization. There are X-11, ARIMA X-11, ARIMA X-12, TRAMO SEATS, BAYESIA, BV4, DAINTIES, DECOMP, GLAS, LOWESS, SABL (Cleveland, Dunn, and Terpenning, 1979), STAMP (Koopman, Harvey, Doornik, and Shephard, 1998), STL. Among these methods, TRAMO SEATS and ARIMA X-12 are the most widely used. They are recommended by EUROSTAT, the European Central Bank, and the International Monetary Fund. The time series of household savings rates was decomposed by means of seasonal adjustment, the ARIMA X-12 procedure and the TRAMO SEATS procedure. The use of both procedures allows the isolation of the seasonal component and calendar effects from the examined time series, leaving the series containing the irregular component and the trend or cycle. Both the ARIMA X-12 procedure and TRAMO SEATS are used and recommended for use by national statistical offices to align time series. In the study, these methods were used to isolate seasonality and identify atypical values and their nature. The Demetra + program was used for calculations.

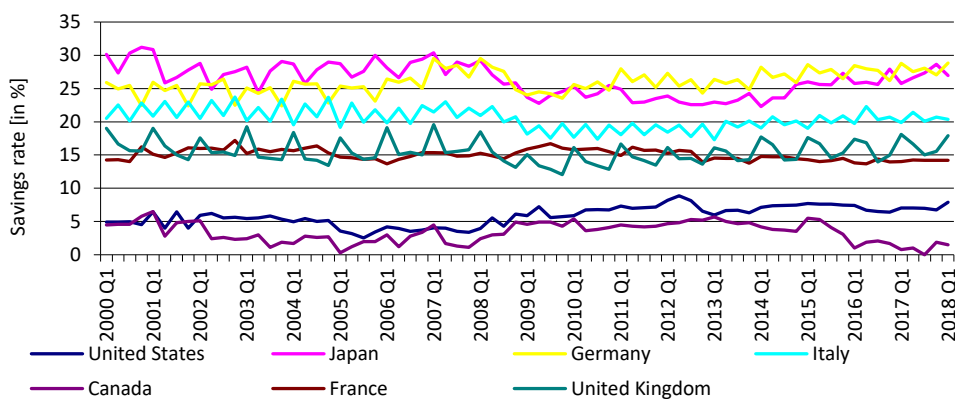
TRAMO-SEATS is the procedure used by EUROSTAT and the Central Statistical Office to smooth time series. It is the reason why this procedure is applied in this study, except that the aim is here not to obtain the smoothed series, but on the contrary, to isolate and to identify seasonality, calendar effects and outliers.

4. Results

Household savings rate in the G7 countries (Figure 1) was at different levels in specific countries. It is not surprising that the highest savings rates are found for

households in Germany and Japan – countries of the most advanced and prosperous economies. The savings rate in these countries ranged between 22% and 32%. The savings rates of the US and Canadian households were below 10%. In this case, already based on the chart itself, it can be noted that these countries considerably differ from the rest, not only in the level of savings rate but also in the lack of visible, cyclical fluctuations, which is noticeable for the European Union countries.

Figure 1. Household savings rate of the G7 countries in 2000-2018



Source: Own work based on data from: U.S. Bureau of Economic Analysis, Statistics Bureau of Japan, Deutsche Bundesbank, National Institute of Statistics, Statistics Canada, French National Institute of Statistics and Economic Studies, Office of National Statistics.

Estimation results obtained using the TRAMO-SEATS procedure indicate that the savings rates of US, Canadian and French households are similar. The estimated models had the same form $(1,0,0) \times (0,0,0)$, characterised by the presence of the moving average process. On the other hand, the savings rate models in Japan, Germany, Italy, and the United Kingdom were consistent for the seasonal part $(0,1,1)$. Calendar effects were only identified in the case of Italy and the United Kingdom, and it was the Easter effect. The weekday effect was not identified. Outliers were detected for each country (Table 3).

The analysis of the household savings rate in the United States identified two outliers, both characterised as a change in the level of the trend. The first one consists in raising the trend level since the second quarter of 2005. The second change is the reduction of the trend level since the fourth quarter of 2012. In the case of Japan, one outlier was identified – raising the trend level in the third quarter of 2008. On the other hand, in Germany, a significant temporary increase in the level of household savings rate was observed in the third quarter of 2009. The household savings rate of the Italian households underwent sudden, single changes (shocks) in the first quarter of 2004 and 2005. In both cases, these were sudden increases. Canadian households, in turn, started to save more after the second quarter of 2001, when the trend level was raised.

Table 3. Estimation results for models of household savings rate in the G7 countries in 2000-2018

Specification	ARIMA model	Moving Average Process*	Easter effect*	Number of outliers
United States	(1,0,0)x(0,0,0)	0.0953 (0.0581)	none	2
Japan	(1,0,0)x(0,1,1)	none	none	1
Germany	(0,1,1)x(0,1,1)	none	none	1
Italy	(0,1,0)x(0,1,1)	none	-0.2396 (0.0302)	2
Canada	(1,0,0)x(0,0,0)	2.9912 (0.0000)	none	1
France	(1,0,0)x(0,0,0)	2.7052 (0.0000)	none	3
United Kingdom	(1,0,0)x(0,1,1)	none	-0.0297 (0.0000)	2

Explanations: * - parameter (asymptotic significance)

Source: Own work based on data from U.S. Bureau of Economic Analysis, Statistics Bureau of Japan, Deutsche Bundesbank, National Institute of Statistics, Statistics Canada, French National Institute of Statistics and Economic Studies, Office of National Statistics.

The highest number of outliers was identified for France. The savings rate of French households rose sharply (shock) in the fourth quarter of 2000 and in the fourth quarter of 2002, while in the fourth quarter of 2012, it recorded a temporary growth. In the United Kingdom, the savings rate suddenly increased (shock) in the fourth quarter of 2007. However, a temporary increase was observed here in the first quarter of 2009. As can be seen, no significant sudden, temporary, or long-term decreases in savings rates were reported for any country (Table 4).

Table 4. Outliers for the household savings rates in the G7 countries in 2000-2018

Specification	Outlier type	Date	Parameter	Significance
The United States	LS	2012 Q4	-2.3344	0.0001
	LS	2005 Q2	1.9015	0.0013
Japan	LS	2008 Q3	0.1191	0.0004
Germany	TC	2009 Q1	3.6236	0.0000
Italy	AO	2005 Q1	1.7471	0.0008
	AO	2004 Q1	1.3067	0.0010
Canada	LS	2001 Q2	3.1471	0.0008
France	AO	2000 Q4	0.1079	0.0000
	AO	2002 Q4	0.1053	0.0000
	TC	2012 Q4	0.1008	0.0013
United Kingdom	TC	2009 Q1	0.1548	0.0000
	AO	2007 Q4	0.0829	0.0014

Explanations: * - parameter (asymptotic significance)

Source: Own work based on data from the U.S. Bureau of Economic Analysis, the Statistics Bureau of Japan, Deutsche Bundesbank, the National Institute of Statistics, Statistics Canada, the French National Institute of Statistics and Economic Studies, the Office of National Statistics.

Using the seasonality analysis with application of tests available in the TRAMO-SEATS procedure, it can be clearly concluded that the savings rate of the US,

Canadian and French households is not subject to seasonal fluctuations. On the other hand, seasonal variations were found for the savings rate of households in Japan, Germany, Italy, and the United Kingdom, while in the case of Italy, the occurrence of moving seasonality was also observed, which may indicate that the level of the savings rate depends on the economic cycle (Table 5).

Table 5. Seasonality tests of household saving rates in the G7 countries in 2000-2018

Specification		Friedman test	Kruskal-Wallis test	Complex test	Moving Seasonality test	Identifiable Seasonality test
United States	S	1.0472	2.8478	0.7265	1.2780	Identifiable seasonality does not occur
	I	0.3797	0.4157	0.5396	0.2443	
Japan	S	24.3514	44.4226	38.2883	1.4792	Identifiable seasonality occurs
	I	0.0000	0.0000	0.0000	0.1408	
Germany	S	194.8462	60.7800	212.2461	1.4565	Identifiable seasonality occurs
	I	0.0000	0.0000	0.0000	0.1501	
Italy	S	72.4156	54.5344	176.0871	3.5504	Identifiable seasonality occurs
	I	0.0000	0.0000	0.0000	0.0002	
Canada	S	0.4968	1.2493	0.9864	1.1504	Identifiable seasonality does not occur
	I	0.6861	0.7412	0.4043	0.3369	
France	S	1.0472	2.8478	0.7265	1.2780	Identifiable seasonality does not occur
	I	0.3797	0.4157	0.5396	0.2443	
United Kingdom	S	111.6916	60.7922	211.8674	1.0226	Identifiable seasonality occurs
	I	0.0000	0.0000	0.0000	0.4513	

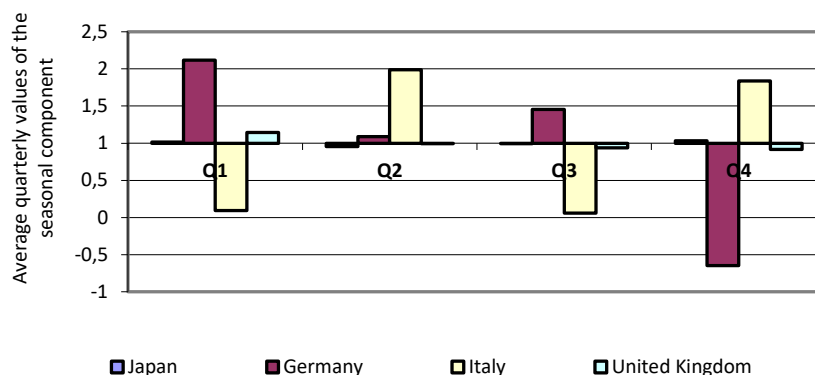
Explanations: *S* – is the value of test statistics, *I* – asymptotic significance

Source: Own work based on data from the U.S. Bureau of Economic Analysis, the Statistics Bureau of Japan, Deutsche Bundesbank, the National Institute of Statistics, Statistics Canada, the French National Institute of Statistics and Economic Studies, the Office of National Statistics.

Figure 2 shows the average annual values of the seasonal component obtained using the TRAMO-SEATS procedure. G7 countries for which seasonality was not found (United States, Canada, France) were omitted. The fluctuations presented in the chart show that the seasonality varied from country to country. When, for example, the German savings rate increased (in relation to the trend), for Italy it tended to decline (Table 6).

The models of saving rates in G7 countries obtained with the TRAMO-SEATS procedure did not have properties of model residuals required for forecasting models. However, the aim of the study was not to forecast future saving rate values, but only to isolate and identify the components of the time series determining the development of the phenomenon under consideration.

Figure 2. Average quarterly values of the seasonal component of the household savings rate in selected G7 countries in 2000-2018



Source: Own work based on data from the U.S. Bureau of Economic Analysis, the Statistics Bureau of Japan, Deutsche Bundesbank, the National Institute of Statistics, Statistics Canada, the French National Institute of Statistics and Economic Studies, the Office of National Statistics.

Table 6. Results of the property tests for model residuals for G7 household savings rate in 2000-2018

Specification	Normality*	Autocorrelation*	Randomness*	Linearity *
United States	0.7071	0.2309	1.0000	0.0064
Japan	0.4396	0.7487	1.0000	0.8552
Germany	0.6418	0.7214	1.0000	0.1598
Italy	0.3867	0.6902	1.0000	0.1662
Canada	0.0446	0.0389	1.0000	0.2979
France	0.7071	0.2309	1.0000	0.0064
United Kingdom	0.9762	0.7991	1.0000	0.6212

Explanations: * – Asymptotic significance.

Source: Own work based on data from the U.S. Bureau of Economic Analysis, the Statistics Bureau of Japan, Deutsche Bundesbank, the National Institute of Statistics, Statistics Canada, the French National Institute of Statistics and Economic Studies, the Office of National Statistics.

5. Final Remarks

The saving rate of households may be related to the supply of financial instruments available in each economy. In more developed economies, households often allocate a portion of their income, in parallel to consumption, to accumulate savings, and financial institutions have the tools to encourage buyers of a variety of financial products. Higher interest rates on savings proposed in financial institutions in various forms (deposits, shares, bonds) and there would be a small risk associated with the purchase of e.g., securities, households would probably be more active in this respect. However, in the light of information about the upcoming economic slowdown mainly in Europe, it can be expected that the most popular forms of

allocation of households' cash resources will be deposits and life insurance. Due to their nature, this will probably not be reflected in increased savings rates.

The saving rate of households in the G7 countries varies from country to country. The main macroeconomic determinants of this phenomenon are macroeconomic factors. For the purposes of the analysis, the focus was only on the level of interest rates. Using the TRAMO-SEATS procedure, was shown that the savings rate of the United States, Canada and France did not undergo seasonal fluctuations. The observed fluctuations are the result of the moving average process and atypical values. However, seasonality of saving occurred in the case of Japan, Germany, Italy, and Great Britain. This seasonality was of a different nature, with the largest seasonal variations recorded for Germany and Italy. In the opinion of the Authors, the presented analyses may contribute to reducing the shortage of Polish literature in this area.

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