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Economic News and Household Decisions

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ABSTRACT This paper is devoted to the role of information context in the dynamics of consumption/savings decisions. The deviations from the traditional model of rational expectations are investigated, and the hypotheses of the «rational inattention» are tested. The basis for the study was a selection of news from the major Russian TV channels for 2006-2016. This news available to ordinary households in Russia was analyzed. News was defined as negative or positive with special program tools of sentiment analysis. It was found that increased uncertainty (the spread of positive and negative news) leads to the choice of consumption to the detriment of savings, which then reduces the investment base of the economy. The authors analyze the connection of the tonality of news and its changes with the real business cycle. The authors found that the information cycle with some lag correlated with the cycle in consumption/savings decisions in the Russian Federation. The authors conclude that the concept of rational inattention is more acceptable for this case. Based on the study, recommendations are offered for adjusting public policy.

KEY WORDS: cycles, information imperfectness, bounded rationality

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1. Introduction

In this paper, we investigate the impacts of economic news on households' decisions concerning income distribution for consumption and savings. Our research is based on the concepts of bounded rationality and information imperfectness. Real-life households make their decisions in an imperfect information environment, and they are unable to use all the relevant information (even if it were available) due to time limits and/or bounded cognitive capacity. Therefore, an outline of the informational context of the household`s decision-making is desirable.

We assume that the decision-making mechanism is as follows. When obtaining and processing becomes costly, according to the concept of rational inattention (see par. 2), people ignore some amount of information and make the choice between consumption and savings with some error. The tonality of economic news obtained from TV channels is the most available and has no processing costs. Therefore, we can suppose that this information should be the bases for decision-making, and more information leads to a lower probability of deviation from the optimal consumption and savings levels.

Our economic news sample is built upon news broadcasted by main Russian TV channels and covers the period from 2006-2016. The Russian case is characterized by the strong trust of households to the TV news (see par. 3) from the major federal channels that have a large audience reach in Russia. Thus, economic TV news and its impacts on households' decisions can be an indicator of the information background for households' decision-making. This news usually does

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not need specific skills or knowledge to be understood. Moreover, we suppose that people perceive news according to sensitive saturation, which is why we evaluated the tonality of news.

For measuring the amount of information obtained through the tonality of economic news, we use the Shannon concept (growth of information means the reduction of uncertainty). Our analysis has two steps. First, we check the Granger causality between the cycle of information growth and the dynamics of savings as the disposable income ratio. After that, we build a model of the «bounded rational household» whose decisions depend on the amount of information obtained and test this model with the «Generalized method of moments». We found that the cyclical component of information growth (isolated with the Butterworth filter) causes the cycle of households' savings ratios in the sense of Granger causality. The model of representative household behavior based on the concept of rational inattention predicts the following situation: the less information that is processed, the more likely that the non-optimality of the decisions and the realistic discount rate where the household consumes more than would be optimal will be. The GMM test of this model was satisfactory.

In the next paragraph, we provide a brief review of the related literature. In section 3, we describe the data and test the Granger causality. In section 4, we build a model of the interaction between household decisions about consumption/savings and the amount of information obtained and then check it with the GMM.

2. Related Literature

Three streams of literature are related to our research. First, we examine works on the impacts of bad and good news on the financial markets, especially on the foreign exchange market. Then, there is a body of research on households' savings under income uncertainty. Finally, the literature on rational inattention plays an important role for our theoretical intuition in this paper.

Mainly, the efficient market hypothesis is tested in the first stream of literature. That is, since the efficient market should absorb all available relevant information, the effects from news should be in the form of good or bad "surprises" about economic activity. It was shown (in the case of the U.S.) that only a few macroeconomic parameters ("surprises" about them) could have an impact on the stock exchange (Flannery & Protopapadakis, 2002). However, most of the studies report that economic news affects volatility rather than stock returns. M. Evans and R. Lyons showed that the effects of foreign exchange are mostly not through direct price adjustment but to a great extent are the results of changes in order flow volatility (Evans & Lyons, 2008). On the other hand, there are cross-border spillovers from economic "surprises", mostly from the U.S. news abroad. Nonetheless, in fact, the significance of such spillovers depends on the magnitude of bilateral trade (Caporale & Spagnolo, 2012; Singh, Nejadmalayeri, & Lucey, 2013) or is connected with periods of world financial crises (Caporale, Spagnolo, & Spagnolo, 2016; 2017). Notably, the psychology of financial market participants could provide its effect. For example, L. Fang and J. Peress found that simple coverage by the media could affect stock returns, even if there is no genuine news that is transmitted (Fang & Peress, 2009).

It should be mentioned that unlike in this research, we use the linguistic estimation of tonality of the whole text of news messages, while previous works usually only analyzed headlines that were classified as "good" or "bad". Therefore, while information background is usually characterized by the ratio of "good" headlines, we are able to operate with the average tonality of news or its variance. Moreover, we can estimate the amount of information (in the Shannon sense) on this basis.

The second stream of the related literature is the literature about how uncertainty influences households' decisions about disposable income. Here, uncertainty is usually treated in "statistical" way that is not like information received from media but is like the variance of income or some accidents such as elections or reforms. In fact, competing reasons affect savings. Precautionary motives make households save more when income is not predictable enough. On the other hand, uncertainty about returns on investments leads to lower savings. It was theoretically shown that the result depends on what is more salient for a decision-maker's attention: income stability or returns on savings (Miao, 2004). Indeed, the investigation of the dramatic rise of savings in China during the 2000s (Chamon, Liu, & Prasad, 2010) or the rise in savings during the German general elections in 1998 (Giavazzi & McMahon, 2012) showed that such sources of uncertainty (like structural changes in the economy, pension reform, change of the political elite, etc.) provoke more savings and less consumption. It seems to contradict to the idea that risk-aversion should lead to decreased savings. In fact, these findings address the threat to lose the current level of well-being, which could play the role of a reference-point in the process of decision-making. In more general situations, risk-aversion leads to rather weak decreases of consumption as a reaction on bad news, whereas consumption increases significantly when the news is good (Bowman, Minehart, & Rabin, 1999). R. Thaler, regarding the behavioral aspects of decisions about pension insurance plans, stated that the mere shift of the emphasis from the current to an alternative plan could result in more switches from one plan to another (Benartzi & Thaler, 2007; Thaler & Benartzi, 2004).

In this literature, the reactions to the dynamics of economic conjuncture and possible threats are investigated but not the question about how households form their knowledge about it and how they operate based on the available information. For our purposes, we need to build a model that captures the effect of information processing on the savings ratios in disposable income.

In our research, we rely on bounded rationality or, more precisely, procedural rationality intuition. That is, individuals balance the probability of an incorrect decision with the cost of accurate decision-making. Recently, the concept of rational inattention was proposed as an approach to the formalization of such a type of bounded rationality. The main idea of the approach is that an individual solves the optimization task such that the more accurate decision (greater probability of correct decision) demands more information (interpreted as the reduction of the initial Shannon entropy of decisions), the processing of which is costly. This view relies on H. Simon's works (Simon, 1976; 1978), and the precise formalization of the concept is due to C. Sims (Sims, 2003; 2006; 2010). The features of this optimization lead to the greater probability of mistakes in a particular direction, while the reduction in information processing costs makes decisions closer to ones that are built upon rational expectations. This leads to important implications for macroeconomic policy. While the view of "new classics" imposes the neutrality of money, an individual reaction on monetary stimulus is only due to imperfect information (Lucas, 1972; Sargent & Wallace, 1976). Therefore, rational inattention demonstrates information problems more straightforward (Martins & Siniigaglia, 2009.) and reveals some effects of monetary policy (Alvarez, Lippi, & Paciello, 2015). In particular, it was shown that due to costly information processing, a representative household counts very little for the dynamics of the real interest rate during a business cycle. Therefore, the interest rate has little impact on households' short-run decisions, while the price level has a significant effect (Maćkowiak & Wiederholt, 2015).

However, in these studies, the amount of information to be processed in order to make the optimal decision was given exogenously with respect to the information environment of the representative household. Therefore, changes in this environment could not have an influence on the decisions. Thus, the macroeconomic policy also does not affect the decisions through this channel. However, it seems plausible that, for instance, the unexpected decisions of government or monetary authorities will be reflected by the growth of uncertainty in economic news from media, which would consequently change the decisions of the representative household. As we hope, our approach could capture this effect, and we address this issue in the discussion.

3. Methodology and results: Information and Saving Ratio Cycles

In this section, we assess the Granger causality between the cyclical components of information growth and savings in the disposable income ratio. We start with the characteristic of the sample and the specification of the information measure that we use. Then, we turn to the problem of causality.

3.1 Sample and Descriptive Statistic

It is difficult (if not impossible) to consider all information and processing costs that influence a household's decisions. To make a proxy for the informational conditions of a household's decision-making, it is necessary to find appropriate messages that are commonly known and sufficiently cheap to process. With these messages, we use the attitudes toward economic news that are given by leading Russian television media. The case of Russian television media is quite convenient, since they have excessively large trust and audiences compared to Internet news, the radio or newspapers. Moreover, three federal TV channels accumulate significantly larger audiences than the other channels that offer economic news. For instance, according to the Russian Center for the Public Opinion Study, which is the most well-known center for investigating public opinion in the Russian Federation (www.wciom.ru), the rating of trust for the TV news in the most recent decade was not less than 50 %, compared to less than 20 % for Internet news. Meanwhile, the absolute outsider is foreign TV news, newspapers, magazines and so on, whose index of trust lies deep in the area of negative values. In 2017, according to Mediascope research agency (mediascope.net), the audience of these channels was 98.5 % of Russia's population and more than 50 million viewers in the CIS and Baltic countries. At present, the main Russian TV companies (VGTRK, ORT, and NTV) either through their «nationalization» or by transferring ownership to affiliated financial and industrial groups, are under the control of the authorities.

On the other hand, the attitudes toward translated economic news are something that lies at an emotional level, and understanding it is a great deal easier than insight into the economic meaning. Therefore, information about attitudes is very cheap information. Together with large audiences and trust, it allows us to expect that most households process this information received from federal TV channels.

We form the sample as follows. The three federal TV channels of 1tv, "Russia 1" and NTV were analyzed. For the period from January 2006 to September 2016, we aggregated the monthly economic messages. To be precise, for every channel in every month, we randomly picked three days. Then, we took the texts of all messages for these dates that were labelled with tag "Economy" from the websites of the channels. To measure the attitude of the author of a message toward a reported news story, we applied sentimental analysis of the text of the message. To realize such analysis, we used the analyzer provided by Eureka Engine (http://eurekaengine.ru). This analyzer measures positive and negative attitudes in a text. The differences between them were used as a measure of attitude as a whole.

Then, we conducted the same analysis with another text analyzer Repustate (Repustate.com). The reason was that the Eurika Engine counts for the economic context of a message, while Repustate provides estimations based on common vocabulary. By doing this, we would like to ensure that it is not a very strict assumption that the representative household takes the economic background of a news story into consideration.

As a result, 6 071 messages were analyzed (1 132 from 1tv, 2 860 from "Russia 1" and 2 089 from NTV). For every month, we estimate the average attitude and dispersion. Then, we compared them with the normal distribution with a zero average and dispersion equal to 0.35 for Eureka Engine (attitude estimates for particular messages were not greater than 1.75 in the absolute value, and 0.35 is roughly a dispersion of normal distribution in the interval [-1.75; 1.75]). For Repustate, we respectively compared the average and dispersion with zero again (0.09 was roughly the dispersion of the normal distribution in the interval [-0.95; 0.95], which is the interval of obtained values of tonality). The reason for this comparison is to ensure that the observed attitudes are not actually "white noise". We present the results in Table 1.

The average tonality of economic news estimated with Eureka Engine over 55 months (42.6 % of months in the sample) significantly deviated from zero (according to Student's t-test with a 5 % level of significance). When we correct the average for different quantities of news provided by different channels and take average of the average tonalities of each TV channel, then the 66-month period (48.1 %) significantly deviates from zero. Surprisingly, the results for the estimations, made with Repustate, considerably differ. Less than a quarter of months in the sample have an average tonality of news during them significantly different from zero.

Thus, operations with the average tonality of economic news are risky, since such analysis is sensible to the assumption about whether the representative household could account for the economic background of received news.

In contrast, the dispersion of economic news significantly differs from the dispersion of the corresponding normal distribution for estimations based on the Eureka Engine and those based on Repustate. This was

Table 1. Number of months when the average mood of news and the dispersion are significant

	Number of months when the average mood significantly differs from zero.	%	Number of months when the average dispersion significantly differs from the normal distribution.	%
Eureka Engine	55	42.6	122	94.6
Eureka Engine (corrected)	62	48.1	122	94.6
Repustate	30	23.3	125	96.9
Repustate (corrected)	31	24.0	125	96.9

the case in 122 months (94.6 %) for the Eureka Engine estimations and in 125 months (96.9 %) for the Repustate estimations (again, according to the Student's t-test with a 5 % level of significance). As could be seen, there is almost no difference between the different estimations. Hence, for more a careful analysis, we should use the dispersion of the tonality of economic news rather than its average tonality.

This conclusion is not unexpected. From the point of view of Shannon information theory, information is a reduction of entropy, and a continuous distribution entropy (or differential entropy for this case) is directly associated with dispersion. Therefore, the next step was to estimate the information associated with a diminished (with respect to the normal distribution) dispersion of attitudes toward economic news.

We consider information as the reduction of entropy from the level corresponding to the normal distribution to the entropy of the normal distribution with dispersion equal to the attitude of economic news within a month. That is:

$$I_i = \frac{1}{2}\ln\left[\frac{s_i^2}{\sigma_i^2}\right], \qquad (1)$$

where I_i is the amount of information translated in month i, s_i^2 stands for the unbiased variance of the normally distributed variable with dispersion equal to 0.35 for the Eureka Engine and 0.09 for the Repustate estimations, and σ_i^2 stands for the dispersion of the attitudes of economic news messages in i months.

Based on formula (1), we could retrace the information dynamics and identify some stylized facts about it. First, there is a remarkable high frequency of fluctuations in the information. For example, Figure 1 shows how information changes over time. We could see that notable changes in information occur from one month to another.

On the other hand, we hardly could find any trend in information dynamics. It could be seen more clearly from Figure 2 where a trend in the information growth rate was isolated with the Hodrick-Prescott filter (λ = 14400). Here, the trend of the growth rate is stable, thus implying constant information growth in the long run, and it is close to zero.

The same features of information dynamics are common to other estimations, such as those corrected with respect to different numbers of economic news in the programs of different TV channels and/or estimations obtained with Repustate.

3.2 Granger causality between information and saving ratio cycles

In this subsection, we estimate the relationship between cycle components of information growth and savings in disposable income ratios. For this analysis, we exclude from disposable income the household mandatory payments, and we eliminate from savings cash and foreign currency remaining in the hands of households. By doing so, we hope to avoid the transactional motive of saving and the mere speculative attempts of households realized by the short-term buying and selling of foreign currency.

We use the Butterworth filter (with the order of the filter equal to 8 and the cutoff frequency equal to

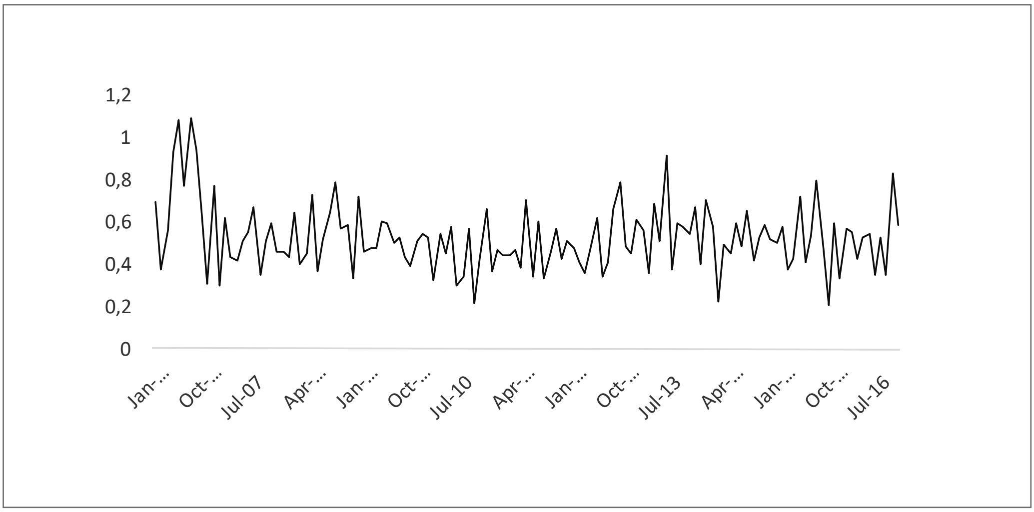

Figure 1. Information dynamics (Eureka Engine estimations)

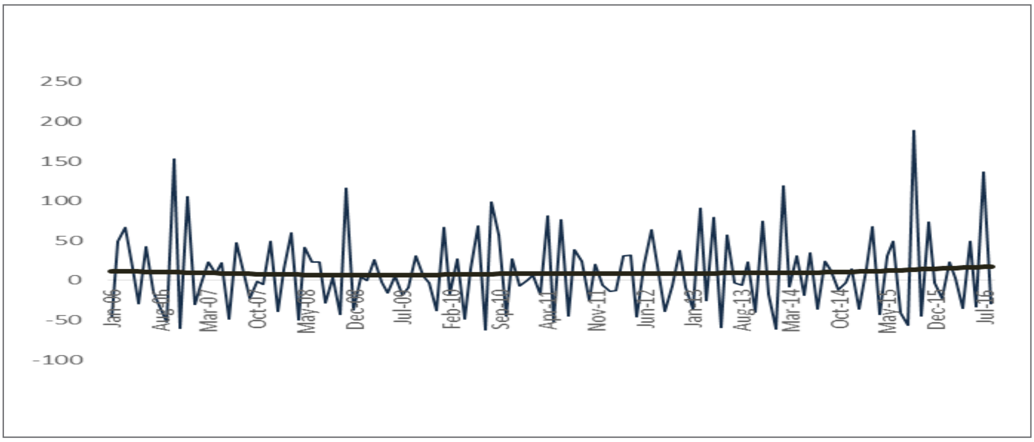

Figure 2. Information growth rate with the Hodrik-Prescott filter (λ = 14400), Eureka Engine estimations

67) to isolate the cyclical components of information and savings ratio dynamics. The reason is that the Hodrick-Prescott filter with the standard parameter λ that is usually used for business-cycle analysis is able to detect any cycle in information growth rate dynamics (see Figure 2). The other reason is that we would like to isolate a cycle from a dynamic that is high-frequency itself and, in the case of the savings ratio, lies in pre-established limits. The Butterworth filter has a maximally flat frequency response that is useful for our goals. Moreover, it could be seen as a variation of the Hodrick-Prescott filter (Gomez, 2001). The characteristics of the obtained trends for the estimations based on Eureka Engine can be seen in Figure 3.

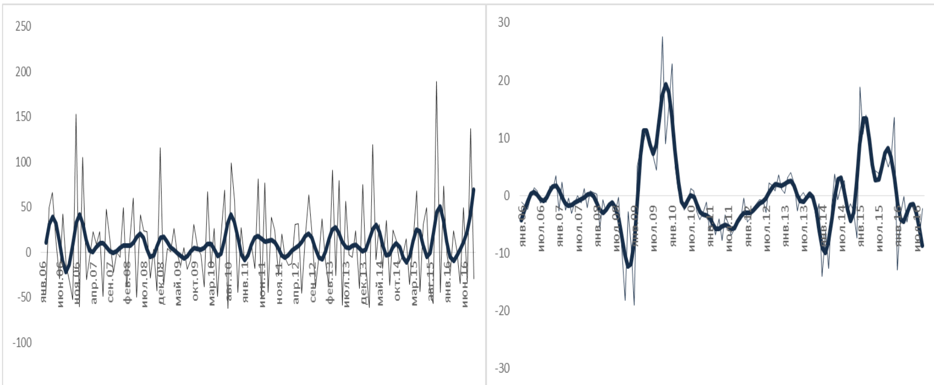

Figure 3. Information growth rate (left), the savings in disposable income ratio (right), and the dynamics with trends (thick lines) isolated with the Butterworth filter (n = 8, cutoff frequency = 67)

First, we check whether the information growth cycle causes the savings ratio cycle in the Granger sense. That is, we estimate

$$\left(\frac{Sav}{Inc}\right)_t = \sum_{x=1}^{12}\left[\alpha_{t-x}\left(\frac{Sav}{Inc}\right)_{t-x} + \gamma_{t-x}\varepsilon_{t-x}\right] + \varepsilon_t\,, \qquad (2)$$

where $\frac{Sav}{Inc}$ is the cyclical component of savings to disposable income ratios and ε is an error.

Then, we compare equation (2) with the following equation and check whether it brings a sufficient improvement to the regression:

$$\left(\frac{Sav}{Inc}\right)_t = \sum_{x=1}^{12}\left[\alpha_{t-x}\left(\frac{Sav}{Inc}\right)_{t-x} + \beta_{t-x}Inf_{t-x} + \gamma_{t-x}\varepsilon_{t-x}\right] + \varepsilon_t\,, \quad (3)$$

where *Inf* stands for the cyclical component of the information growth rate.

The null hypothesis is that Inf_{t-x} are redundant variables. The Wald test has shown that with *p-value = 0.04*, the null hypothesis is rejected. That is, the information growth cycle does cause cyclical changes in the savings to disposable income ratio.

For further analysis, we analyzed how the informational growth cycle arises in its turn. It is attractive to link this cycle to any characteristics of macroeconomic indicators' dynamics. Since the main problem for a household is to distinguish between the real and nominal parameters of the current macroeconomic situations, the movements of real indicators should increase the certainty of decisions, while the movement of nominal (mostly monetary) indicators should increase their uncertainty. We estimated the autoregressive model as:

$$Inf_t = \sum_{x=1}^{12}\left[a_{t-x}GDP_{t-x} + b_{t-x}M2_{t-x} + c_{t-x}e_{t-x}\right] + e_t\,, \qquad (4)$$

where *Inf* is the cyclical component of the information growth rate, GDP is the cyclical component of the GDP growth rate, *M2* is the cyclical component of the M2 growth rate, e is the error, and a, b and c are the regression coefficients. All cyclical components were isolated with the Butterworth filter. The dates for GDP and M2 were obtained from the official Russian statistics and were seasonally adjusted.

The best specification of equation (4) shows that the coefficients for all errors are statistically significant, and some coefficients for the lags of GDP and M2 growth rates' cycles were also statistically significant (see Table 2; to save space, we present only the values of a and b).

Table 2. Estimation of equation (2)

	Value	St. error
a(t-1)	6.8443***	1.9043
b(t-5)	3.9877**	1.9171
b(t-9)	- 13.5684***	2.1997
b(t-11)	- 15.0659***	2.3819

** 5 % significance level, and *** 1 % significance level. All c values are significant at the 1 % level and lie in the interval [- 29.3322; - 0.3311]. c(t-5) and c(t-6) have the highest absolute values. $R^2 = 0{,}999$

Using the results of the estimation of equation (4), we determined the unexpected component of the information growth rate cycle as an error in the regression (e_t). Now, we return to the Granger causation and estimate

$$\left(\frac{Sav}{Inc}\right)_t = \sum_{x=1}^{12}\left[d_{t-x}Sav_{t-x} + g_{t-x}e_{t-x}\right] + \varepsilon_t, \qquad (5)$$

where e is the error from equation (2), and *d* and *g* are regression coefficients.

The result of the estimation of equation (5) shows that all values of d are significant at the 1 % level and are in the interval [- 28.1875; - 0.7214]. Additionally, the most absolute values were for d(t-5)-d(t-7). Excluding e(t-x) with the insignificant g(t-x), we found that only g(t-11) is statistically significant at the 1 % level (g(t-11) = 0.0265 with standard deviation 0.0074). $R^2 = 0.989$, and the Wald test denies the null-hypothesis of g(t-11) = 0 with p = 0.0001 ($\chi^2(1) = 14.6796$). Therefore, we could conclude that unexpected deviations in the information growth rate cycle cause the savings to the disposed income ratio.

Again, additional information increases savings, which corresponds to our leading hypothesis. However, some information is not determined by GDP or M2 dynamics. Possibly, this information could be seen as "pure" information that does not follow statistical reports.

Our findings could infer political implementations that could be partially related to the macroeconomic policy of "new classics" and could be partially seen as an alternative to this policy.

The part of the information that is unconditional on GDP and M2 decisions affects (with lag) households' decisions about consumption and savings. Therefore, macroeconomic policy should count for such influence, since it could lead to over- or underinvestment. When this unconditioned part of information grows, it is possible to neutralize it by increasing the other part of the information growth cycle through (according to (4)) a current decrease in M2 growth or an increase in GDP growth (if it is possible through budget and fiscal policy). If the GDP growth rate falls, the M2 growth rate should also be decreased, and vice versa.

However, manipulations of M2 growth could affect savings and reduce interest rates, which in turn would stimulate economic growth. An increase in GDP growth could ceteris paribus reduce the amount of information in addition to that produced by the GDP and M2 dynamics. Then, households will decrease their savings in future periods, which would increase the interest rate, constrain further economic growth, and so on. Therefore, a cyclical dynamic is produced.

However, the best evidence for such logic was obtained through the Butterworth filter, which restrains the absolute value of the described effects. Most of the savings per income ratio fluctuations fall in the trend, while the cyclical component is relatively small.

4. The Model: Rationally Inattentive Household and Decisions about Consumption and Saving

In the previous section of our work, we found the causality between the cyclical component of information growth and the savings ratio. In this section, we try to substantiate the impact of information with a model that shows the decision-making about consumption and savings in an explicit way.

4.1 Baseline Model

We suppose infinitely living rationally inattentive consumers, which seek to maximize their overall utility:

$$u=\int_0^{\infty}\int_0^{\infty}\beta^t p(c(t))dc(t)dt \tag{1}$$

where:
β is the discount factor, c(t) is the consumption in period t, u(c(t)) is the utility of consumption, and (c(t)) is the probability of choosing the amount of consumption c(t) in period t.

A «rationally inattentive» entity maximizes their general utility by means of establishing p(c(t)) for each amount of consumption c(t) in every period subject to the following constraints:

a) Budget constraint:

$$E\dot{a}(t)=a(t-1)r(t)+w(t)-\int_0^{\infty}p(c(t))c(t)dt \tag{2}$$

where a(t) is the assets retained by the entity in period t, r(t) is the interest rate, and w(t) is labor income in the period t.

b) Information constraint:

$$I(t)=H+\int_0^{\infty}p(c(t))\ln(p(c(t))dc(t) \tag{3}$$

where H is the initial entropy of decision-making that is determined by the prior probability c(t) (that is, $H=-\int_0^{\infty}p_0(c(t))\ln(p_0(c(t))dc(t)$ where $p_0(c(t))$ is the prior probability to choose the amount of consumption that equals c(t)), and I(t) is the information available in period t that is set as the reduction of the initial entropy H.

c) Probability constraint:

$$\int_0^{\infty}p(c(t))dc(t)=1 \tag{4}$$

By solving the dynamic optimization problem, we obtain the following:

Definition 1. The entity is rationally inattentive if the decision concerning consumption leads to the maximization of the utility function (1) subject to constraints (2)-(4).

Proposition 1. Ceteris paribus, the rationally inattentive entity chooses the amount of consumption c(t) in period t with a probability:

$$p(c(t))=\frac{\exp\left(\frac{\beta^t u(c(t))-c(t)\exp(r(t)t)}{\kappa(t)}\right)}{\int_0^{\infty}\exp\left(\frac{\beta^t u(c(t))-c(t)\exp(r(t)t}{\kappa(t)}\right)dc(t)} \tag{5}$$

Proof. The rationally inattentive entity seeks to maximize the utility determined by formula (1) subject to (2)-(4). Then, the Hamiltonian is as follows:

$$H=\beta^t u(c(t))p(c(t))+$$
$$-\lambda(t)\left[a(t-1)r(t)-w(t)-\int_0^{\infty}c(t)p(c(t))dc(t)\right]+$$
$$-\kappa(t)\left[H-\int_0^{\infty}p(c(t))\ln p(c(t))dc(t)\right]-\nu\left[\int_0^{\infty}p(c(t))dc(t)-1\right],$$

where *κ(t)* is the costs of processing a unit of information in period *t*.

By applying the Pontryagin principle, we obtain

$$p(c(t))=\exp\left[\frac{\beta^t u(c(t))-\exp(r(t)t)c(t)}{\kappa}-1-\mu\right].$$

Then, using condition (4), we reach result (5).

Definition 2. A path of consumption is the sequence c(0), c(1), …, (c(t)), c(t+1), …, that is, for each c(t) and c(t-1) on the path of p(c(t)) = p(c(t-1)).

Quite straightforward, from Proposition 1, the following can be stated:

Proposition 2. On the path of non-zero consumption for each c(t), β, and c(t-1)

$$\frac{\beta^t u(c(t))-c(t)\exp(r(t)t)}{\kappa(t)}=$$
$$=\frac{\beta^t u(c(t-1))-c(t-1)\exp(r(t-1)t)}{\kappa(t-1)} \tag{6}$$

It seems noteworthy that according to (6), greater information processing costs (κ) result in fewer savings with realistic discount and interest rates. It is an important deviation from the rational expectation approach, according to which a decision-maker

Table 3. GMM estimations

	I	II	III
β	0.99672 (0.00182564)	0.997323 (0.000513351)	1.00088 (0.000478386)
θ	-8.86833e-05 (0.000235572)		−0.00413666 (0.00332837)
k	20.2327 (4.84185)	23.4219 (5.27175)	
Q[TQ]	6.52982e-007 [8.29287e-005]	2.25561e-012 [2.88718e-010]	0.0837819 [10.6403]
χ^2	8.29287e-005	2.88718e-010	10.6403

is indifferent about a direction of his/her mistake. In our case (i.e., the rational inattention approach), a decision-maker would prefer to deviate from the optimum toward greater consumption than toward greater savings.

4.2 Testing the baseline model with GMM

In our research, the information transfers to the entity through the free channel federal economic TV news. We assume that the information ($\widetilde{I}(t)$) received through this channel reduces the information processing costs according to the function $\kappa(t) = \widetilde{I}(t)^{-k}$.

By allowing t=1 for adjacent periods t and t-1 and applying the CRRA utility function, we can infer the following function for the GMM estimation.

$$E_t = \left[\left(\beta \frac{c(t)^{1-\theta}}{1-\theta} - c(t)\exp(r(t))\right)\widetilde{I}(t)^k + \right.$$
$$\left. -\left(\frac{c(t-1)^{1-\theta}}{1-\theta} - c(t-1)\right)\widetilde{I}(t-1)^k\right] = 0 \qquad (7)$$

We estimate three parameters: the discount factor β, the risk aversion θ and the elasticity of information processing costs based on the affectivity of federal TV channels' economic news $\widetilde{I}(t)$ - k. Note that, unlike in the previous section, we use all consumption (corrected for the changes in the price level) and not its ratio to disposable income. For the interest rate (r), we use the interest rate on 1-year deposits.

We present the results for the estimations of news tonality based on Eureka Engine in Table 3. Here, the direct estimation of equation (7) is presented in column I. Column II presents the estimations with the assumption of no constant risk aversion, i.e., $\theta = 0$. Column III contains the valuations of the parameters of the standard consumption capital-asset-pricing model (CCAPM).

We see that according to the GMM criterion and the Sargan-Hansen J-test, the rational inattention model of the representative households' decisions better fits the data than the CCAPM. The risk-averse parameter θ is insignificant in both models (columns I and III). Moreover, when θ is allowed to be zero, we obtain even better results. Then, instead of the non-plausible interpretation of the insignificance of θ in the way of the risk-neutrality of the household, we could suggest that the level of risk aversion is generated by information that is available from economic news and broadcasted by TV channels.

Additionally, we find verification for our hypothesis that with realistic discounts and discount rates, rationally inattentive households prefer to make a mistake toward greater than optimal consumption. Indeed, a discount rate equal to 1 is a great deal larger than the interest rate on bank deposits. In this case, from formula (7), it follows that more information leads to less consumption.

5. Conclusions

To draw conclusions, we stipulate the following findings from our analysis:

- The information growth cycle does cause the savings ratio cycle;
- The information growth cycle is mainly determined by economic growth and the M2 growth cycle, and the remaining part of the information growth cycle also affects savings;
- Rational inattention assumption predicts higher probability of mistakes toward higher consumption (with plausible interest and discount rates); and
- GMM estimation confirms the prediction and obtains better results than the rational expectations model.

We can also make fundamental conclusions for modern economics:

- The information factor plays an important role in the process of households' decision-making about the distribution of disposable income between consumption and savings.
- The information growth cycle does cause the savings ratio cycle. The information growth cycle is mainly determined by economic growth and the M2 growth cycle, but the remaining part of the information growth cycle also affects savings.
- With the increasing uncertainty of the information environment, households prefer the strategy of risk avoidance and make choices in favor of consumption.
- The behavior of households confirms the concept of «rational inattention».
- The disregard of the information factor in the state policy can cause its ineffectiveness.

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