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Behavioral economics

INTERTEMPORAL CONSUMPTION AND LIFECYCLE IN A PANDEMIC CONTEXT: AN EXPERIMENTAL APPROXIMATION

CONSUMO INTERTEMPORAL Y CICLO DE VIDA EN UN CONTEXTO DE PANDEMIA: UNA APROXIMACIÓN EXPERIMENTAL

CONSUMO INTERTEMPORAL E CICLO DE VIDA EM UM CONTEXTO DE PANDEMIA: UMA APROXIMAÇÃO EXPERIMENTAL

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Abstract

The Covid-19 pandemic generated uncertainty among consumers, a slowdown in consumption and an increase of the added saving at world level, the microeconomic evidence showed a tendency towards dissaving and growing consumption. These variations activate questioning about the consequences of confinement in intertemporal consumption, at the same time they allow to provide new empirical evidence about life-cycle models in their standard or neoclassical and behavioral versions. The purpose of this work was to experimentally evaluate the intertemporal consumption patterns from the postulates of both life cycle models. To this end, an experimental simulation exercise of online purchases of commodities was carried out with the participation of 210 consumers who were subjected to treatments that included a baseline, income increase scenarios and no-income withdrawal scenarios. The results verified the existence of consistent responses with the behavioral model in 85% of the cases and with the standard model for the remaining 15%; that is, the tendencies to smooth consumption and increase savings were in the minority in the group evaluated and the confinement context did not translate into more self-controlled intertemporal consumption behaviors.

Keywords: saving; economic behavior; consumer; experimental method; decision theory.

JEL: C09; D01; D11; D12; E21.

Resumen

La pandemia por Covid-19 generó incertidumbre en los consumidores, desaceleración en el consumo y aumento del ahorro agregado a nivel mundial, la evidencia microeconómica mostró tendencia al desahorro y consumo creciente. Estas variaciones motivan cuestionamientos sobre las consecuencias del confinamiento en el consumo intertemporal, al tiempo que permiten aportar nueva evidencia empírica sobre los modelos de ciclo de vida en sus versiones estándar o neoclásica y comportamental. El propósito de este trabajo fue evaluar experimentalmente los patrones de consumo intertemporal a partir de los postulados de ambos modelos de ciclo de vida. Para ello se planteó un ejercicio experimental de simulación de compras en línea de productos básicos en el que participaron 210 consumidores quienes fueron sometidos a tratamientos que incluyeron una línea de base, escenarios de aumento de los ingresos y escenarios de retiro con

ausencia de ingresos. Los resultados permitieron verificar la existencia de respuestas consistentes con el modelo comportamental en 85% de los casos y con el modelo estándar para el 15% restante, esto es, las tendencias a suavizar el consumo y elevar el ahorro fueron minoritarias en el grupo evaluado y el contexto de confinamiento no se tradujo en conductas de consumo intertemporal más autocontroladas.

Palabras clave: ahorro; comportamiento económico, consumidor, método experimental, teoría de las decisiones.
JEL: C09; D01; D11; D12; E21.

Resumo

A pandemia de Covid-19 gerou incerteza entre os consumidores, um abrandamento do consumo e um aumento da poupança agregada em todo o mundo; os dados microeconómicos mostraram uma tendência para a despoupança e o consumo crescente. Estas variações motivam questões sobre as consequências do confinamento no consumo intertemporal, ao mesmo tempo que permitem fornecer novas evidências empíricas sobre modelos de ciclo de vida nas suas versões padrão ou neoclássica e comportamental. O objetivo deste trabalho foi avaliar experimentalmente padrões de consumo intertemporais com base nos postulados de ambos os modelos de ciclo de vida. Para o efeito, foi proposto um exercício experimental de simulação de compras online de produtos básicos, no qual participaram 210 consumidores e foram submetidos a tratamentos que incluíram uma linha de base, cenários de aumento de rendimento e cenários de retirada sem rendimento. Os resultados permitiram verificar a existência de respostas consistentes com o modelo comportamental em 85% dos casos e com o modelo padrão para os restantes 15%, ou seja, as tendências para suavizar o consumo e aumentar a poupança foram minoria no grupo avaliado e O contexto de confinamento não se traduziu em comportamentos de consumo intertemporais mais autocontrolados.

Palavras-chave: poupança; comportamento econômico; consumidor; método experimental; teoria da decisão.
JEL: C09; D01; D11; D12; E21.

Introduction

The confinement declared in Colombia in March 2020 produced important changes on consumption at an aggregated level. According to Bancolombia's economic outlook report, the first of these changes was a decrease in household spending of 5.15% in April, with a tendency to remain negative throughout the year. Segments of the services sector such as entertainment (-62.12%), transportation (-50.02%) and the manufacturing sector such as fashion (-44.41%) registered the most significant drops in terms of spending for the same month. Meanwhile, there were less severe drops in housing (from 7.10% to 6.91% between March and April), an increase in purchases of products such as food (12.79%) at the beginning of the confinement and positive variations in health expenses (20.82%) in April 2020 (Bancolombia, 2021).

The observed patterns by product group revealed consumer priorities as a result of the confinement and they are a reasonable response to uncertainty about the future and to government policies to limit the advance of the virus (Guglielminetti & Rondinelli, 2021).

The evidence to worldwide ratifies these observations. In Europe and the United States Guglielminetti & Rondinelli (2021) put in evidence that saving grew and consumption slowed down with the following trends: for the European Union the consumption fell about 8%, in contrast, the saving grew 7% in 2020 and in the United States the consumption had a slowdown of about 4% for the same period and a saving growth of 9%. In India, the consumption also recorded a slowdown that became more acute in the confinement cycles (Srivastava & Bhanot, 2022) and in China a propensity to save over spending was found in the phases with greater severity in confinement (Jin et al., 2021).

The second important transformation in observed consumer behaviors was the increased propensity to use digital channels for shopping. Castañeda & Hernández (2021) found that e-shopping grew nationally and internationally and that the trend was much more evident in Colombia than abroad throughout 2020.

At the microeconomic level and in non-pandemic contexts, consumer behavior in intertemporal choice scenarios had been found to mostly confirm the predictions of the behavioral

life-cycle model proposed by Shefrin & Thaler (1988). According to this model, consumers have increasing consumption patterns over their lifetime that become more acute in the presence of a wider repertoire of goods. However, given the macroeconomic trend observed, it is worth asking what were the patterns of individual spending and saving in a pandemic context? Do the patterns of the behavioral model of Shefrin & Thaler (1988) hold or did consumers adopt a more measured spending behavior as predicted by the model of Modigliani & Brumberg (1954).

The question is relevant if we consider that in the field of economics there is still no consensus on the evidence of intertemporal consumption patterns, since the neoclassical postulates of the standard model state that individual consumption and saving patterns follow the Modigliani & Brumberg (1954) approaches with stable consumption throughout life, saving during the early stages of life and dissaving after retirement, while in the behavioral models it has been found that the tendency to dissave is more frequent in the early stages of life and that in retirement the preference for saving is more marked (Green et al., 1994).

The diversity of observed patterns has led to the development of models that broaden the spectrum of analysis of consumption and saving standards in the life cycle. Attanasio & Weber (2010) carried out a complete theoretical and empirical review of life-cycle models that includes, among others, the collection of evidence on individual behavior (Attanasio & Borella, 2006), the evolution of consumption in cross-sectional data (Deaton & Paxton, 1994), as well as the explanations that have been constructed in relation to the existence of liquidity constraints and the fall in consumption after retirement (Alessie et al., 1997). The authors emphasized macroeconomic approaches in which the first-order conditions of the intertemporal optimization problem are used to construct the Euler equations of consumption[1].

The use of the macroeconomic approach from Euler equations can be identified in previous work such as Jørgensen (2016) which ratifies the effect of children on the intertemporal consumption of credit-constrained households. For their part, Quintana-Domeque & Wohlfart (2016) study household consumption with Euler equations in the presence of richer reference

[1] A detailed review of the historical evolution and empirical works based on the Euler equations can be found in García (2018).

groups and argue that the evidence found did not allow to identify relative concerns of a group for the intertemporal consumption of the richer group, except in the case of some counties with relatively low levels of inequality.

Carbone & Infante (2014) have opted for experimental approaches on intertemporal consumption based on a five-period design that is developed in Z-tree Software. In this work participants can not anticipate the future income scenario, even if they are in short time horizons, this situation of uncertainty usually induces more conservative behaviors and smoothed consumption patterns. They also present findings around intertemporal consumption planning between groups and at the individual level and recognize that, although individuals and groups plan their consumption with different methods, the difference between them disappears when they face with a new sequence. Only groups that are paired again in a later experimental phase show a worse performance in solving the intertemporal consumption problem (Carbone & Infante, 2015).

From a microeconomic perspective and within the framework of behavioral economics, models are proposed in which there is an ordering of objectives for each period, based on the existence of bounded rationality. Binswanger (2012) proposes a model characterized by two components: a static and a dynamic one. The static component is stated in two periods in which an insurance objective is set in which a scenario of loss aversion is considered and the desire to consume at least a portion of what is currently consumed in the future is taken into account, and a second objective in which the need to maintain a certain standard of living in a normal scenario is considered. In the dynamic component incorporates uncertainty and the possibility that there may not be a complete plan of action previously defined.

By virtue of the shown findings, the concern about near-optimal behavior and the circumstances under which optimal consumption is chosen in intertemporal terms still persists. Nevertheless, questions about behavior in short-run choice scenarios with income uncertainty in contexts of product access restrictions persist. This research focused on characterizing spending (consumption)/saving choice patterns in intertemporal terms in a context of confinement. For this purpose, the use of experimental methods was favored with the creation of a simulation environment for online purchases of basic products, including food, beverages and household

appliances. The simulation proposed six purchase periods that emulated different stages of the life cycle (two stages comprising the first years of life, two intermediate stages of a productive nature and the remaining two covering the retirement years). The simulation was run in a context of strict confinement to 210 participants ranging in age from 18 to 66 years old.

Theoretical framework

The Modigliani & Brumberg life-cycle model

The origin of the analysis of the relationship among consumption, savings and income can be traced back to Keynes (1965) who assumed the existence of a direct relationship between consumption and income with a marginal propensity to consume decreasing before increases in the income profile and a stable behavior of consumption over time. Subsequently, Modigliani & Brumberg (1954) extended these approaches by assuming that individuals can plan their future consumption, maximize their utility through consumption and they are aware that after retirement they must have their savings available to procure the level of consumption they have projected.

Thus, in the life-cycle model, the pattern of intertemporal consumption depends primarily on current income, future income and inherited wealth. In addition, consumption is determined by individual preferences, since they determine the individual maximization process, and by the types of interest which are a measure of the change in the value of money over time. Thus, and following the formulation presented by Lera (1996) consumption can be described as presented in Equation (1) below:

$$C = \partial Y^L + \beta W \qquad (1)$$

Where $\mathbf{Y^L}$ corresponds to labor income and W represents aggregated wealth. Noticing that consumption is a positive function of current income and wealth, implying that increases in labor income and wealth become increases in consumption.

Deaton (2005) documents that the life-cycle model approaches count on empirical evidence for and against them and constitute an important starting point for the debate on retirement savings at the macroeconomic level. However, the model is not limited to reflections on national income

and retirement savings; there are also microeconomic implications whose validity can be examined in detail as follows:

−In the presence of a constant income, the savings rate would have a constant and positive growth before retirement and it decelerates once retirement occurs.

−Consumption exceeds current income throughout the early stages and, therefore, individuals incur debts to increase consumption.

−When income profiles rise, the maximum levels of accumulation occur, saving rises and consumption is maintained.

−In the absence of current income, the saving fall sharply as the consumers begin to rely on their income to procure consumption.

−Consumption is a stable proportion of current income and accumulated wealth over time.

−Although these approaches were verified at the macroeconomic level by Ando & Modigliani (2005), doubts persist about their validity at the microeconomic level which are associated with their starting assumptions: full rationality, the stability of individual consumption throughout life (Shefrin & Thaler, 1988) and with the tendency to dissaving at the end of life, since Green et al. (1994) showed that dissaving is more frequent in the early stages of life and that in retirement the preference for saving is more marked. Hence, a behavioral alternative to this model has been formulated.

The behavioral life cycle model

The behavioral life-cycle model starts relaxing some assumptions of the standard model to strengthen its predictions. Thus, it assumes that economic agents have devices such as pension plans that are associated with self-controlled behaviors and allow them to postpone a portion of their consumption for retirement. At the same time, it assumes the existence of mental calculation according to which individuals segregate their accounts between current income, wealth and future

income, and this segregation becomes spending patterns which are different, depending on the source of income that is considered (Thaler, 2008). Finally, they recognize the effects of the environment and in particular the implications of the way in which increases in wealth are described, so that the way in which information is framed will have an impact on individual behavior (Tversky & Kahneman, 1981).

Consequently, the behavioral life-cycle model assumes a dual preference pattern in which individuals have an internal conflict between two roles: the doer (with lower levels of self-control) and the planner (with long-term vision and greater self-control).

We assume an individual whose life spans T periods and who has current income throughout his life, represented by: $y = y(y_1, y_2, \dots, y_T)$. To simplify the model, an interest rate equal to zero is assumed and it is assumed that by retirement age the individual will have exhausted all his wealth.

Lifetime wealth is defined by Equation (2) and corresponds to the sum of current income over an individual's lifetime:

$$LW = \sum_{t=1}^{T} y_t \qquad (2)$$

For its part, consumption is represented by $c = c(c_1, c_2, \dots., c_T)$ and the lifetime budget constraint is $\sum c_t = LW$.

The doer is assumed to be pathologically myopic, he concerned only with the current consumption and it is represented by a sub-utility function $U_t(c_t)$. Likewise, the planner's priority is to maximize a utility function of the doer's life horizon.

The utility maximization process is affected by the temptation or by the size of the basket of goods available for individual consumption, so that an opportunity X_t must be defined to represent the feasible choices at time t.

Given the dual conflict presented, it is further presumed that in this case the doer would prefer a high c_t and the planner would opt for a smaller one and that if willpower reduces c_t there must be some physical cost. This physical cost is described in Equation (3) and it will be assumed to be a negative sensation arising from guilt, which diminishes the positive sensations associated with U_t . The total utility of the doer will be the sum of pleasure and pain, where Z_t represents the total utility U_t the pleasurable component of the function and W_t the painful component associated with guilt:

$$Z_t = U_t + W_t \qquad (3)$$

Finally, a willpower variable θ_t. is defined. The function $\theta_t^*(c_t, X_t)$ measures the degree of willpower required to induce the individual to choose consumption c_t when it faces with the opportunity set X_t.

The presented formulation has three central implications: i) a reduction in consumption will be associated with an increase in willpower or with a limited and available basket of goods for consumption; ii) a greater influence of the doer over the planner leads to higher levels of consumption, iii) the nature of spending changes depending on the source of income and creates a tendency to the segregated consumption.

The studies that serve as the basis for this article are based on two bodies of literature: the first of them, it is associated with the empirical evidence that contrasts the two life-cycle models proposed, and the second one presents a synthesis of the macroeconomic evidence that tests the standard life-cycle model.

Levin (1998) offers comparative evidence of the life-cycle models in his study and reflects on the effects of the nature of financial assets on consumption and saving decisions. His findings show that, with liquidity constraints, the behavioral model has a better fit to the analyzed micro data than the conventional model.

Their results allow to recognize the existence of the mental calculation phenomenon in household decisions, while providing evidence of behavioral changes when there are problems of self-control.

In a pandemic context, DiCrosta et al. (2021) examined consumption patterns by means of a questionnaire and for a strict confinement moment in Italy with 4121 participants who were related with the psychological factors such as depression, anxiety, stress and perceived economic stability. The authors found that consumption of necessary goods was associated with fear and anxiety and the consumption of goods with lower level of need with depression.

Graham & Isaac (2002) set out to make a contrast between the neoclassical version of the life-cycle model (Modigliani & Brumberg, 1954) and the behavioral version (Shefrin & Thaler, 1988). To this end, they conducted a survey for 109 participants in which they proposed decision scenarios about payment modalities and hypothetical situations in which additional income was received. The evidence presented by these authors concludes in favor of the behavioral version and it rejects the predictions of the neoclassical (standard) model, since a pattern of rationality closer to the behavioral assumptions is observed; thus, individuals tended to choose alternatives with lower present value.

The work of Koehler et al. (2015) ran a simulation exercise of a life cycle that is composed by 24 periods, where each period represents 3 years of life. During the first 18 periods the participant receives income and in the six remaining periods he/she will be in retirement. The participants had to estimate the amount of expenses for each period, the simulation did not allow them to move forward unless they had a minimum expense. After applying the exercise to 165 participants, it was found that they smoothed their consumption to ensure spending in retirement. This pattern is consistent with the observed trends in the standard life-cycle model.

Statman (2017) focuses on the policy implications of both formulations. Through a comparison of the theoretical approaches, which he accompanies with general evidence on behavioral and savings patterns in the United States based on previous researches, he concludes that both models provide valuable information in terms of public policy, as the standard model is

based on desirable financial behavior that can be altered by emotional or cognitive errors and by devices to favor savings that are more consistent with the behavioral model. To that extent, both models describe behavioral patterns that can be registered and, therefore, both of them offer lessons for the policy design.

In the case of the standard life-cycle model, the work of White (1978) shows that, in a simulated environment, the model's predictions fail in 42% of the cases; the author also points out that the approach to this model with regression methods is usually imprecise. This criticism is added to others such as that formulated by Tobin (1967) who states that, if savings are accumulated in the intermediate stages of life, it can be expected that people consume more in the first stages because they expect higher income in the future, if this is the case, the dissaving would occur in the first and last stages.

Carroll (1997) examines savings data at the aggregated level and finds that households do not have an accumulation pattern as described by the life-cycle model. Deaton (2005) argues that, as in the case of Carroll (1997) study, there are few results which allow to verify the fulfillment of the assumptions of the life-cycle model, among those ones who do their work are: Ando & Modigliani (2005), but Shefrin & Thaler (1988); Deaton (1991) and Laibson & Harris (2001) who find their approaches in a problematic way.

Thus, it can be affirmed that it is necessary to examine broader formulations of the standard model that withstand empirical testing and that allow to recognize the consumption and savings patterns that characterize households at the macroeconomic level and individual agents at the microeconomic level.

After analyzing the core literature reviewed, it is found that the evidence is not conclusive on life-cycle models, as empirical evidence from surveys and analysis of microeconomic and macroeconomic data provides a basis for both approaches. Nevertheless, the papers presented focus primarily on non-experimental contrasts, so the response of participants in more controlled settings is unknown.

Within the framework of the studies which document variations in consumption and saving during the pandemic presented in the introduction, descriptive characterizations and survey-based measures predominate, proving the existence of changes in consumption patterns associated with the uncertainty that resulted from confinement and the rapid spread of contagions.

The present study is proposed as a contribution to the debate on life-cycle models, providing experimental evidence at the same time as the consumer behavior patterns in strict confinement contexts by means of an online shopping simulation. The following section describes the methodological design and resources used in the construction of the simulated shopping environment.

Methodology

Participants

The experimental exercise was executed during August 2020 with 210 students of the Grancolombiano Polytechnic University Institution, who are enrolled in technological, profesional and specialization programs of the Faculty of Business, Management and Sustainability. By the time when Colombia was in mandatory preventive isolation, which implied confinement of most of the country's inhabitants and restrictions of movement, except in particular cases.

The age range of participants was between 18 and 66 years old. The highest concentration was of young people between 18 and 35 years old who represented the 93%, the 57% were women and the remaining (43%) were men. Each one received extra points in evaluative activities for their participation in this research, which were executed online after a prior reading of the informed consent in which the benefits and risks of participation in the simulation were announced. The average time of participation in the simulation was 20 minutes.

Design

The research design was experimental in nature. A shopping environment was programmed to assess the purchasing behavior in the face of current income variation settings and taking into account the formulations of the life cycle models. Additionally, an initial form was included prior

to the completion of the task in which age, educational level, gender, number of people in the household and previous experience with credit cards were inquired.

Subsequently, the shopping environment was presented through Visual Basic with an offer of 42 products defined on the basic basket of Good in Colombia. The participants read a brief description of the task to be performed specifying, that they should include in their purchases, all the products they required for their consumption during a week.

The description included a detail of the life cycle stage in which the participants were. For periods 1 and 2, the participants were to assume that they were young and had no income of their own; period 1 was used as a baseline, and in period 2 a variation of product prices was recorded that could be interpreted as a loss of purchasing power. In period 3, it was assumed that the participants enterer an adult stage and began a productive cycle in which they received income; in addition, the number of products offered, was expanded and new categories such as beverages and household appliances, were included. In period 4, their income grew and they remained in the productive stage, there was also a new increase in prices. In periods 5 and 6, participants had to assume that they had retired and, therefore, did not receive income. That is, the wealth accumulated, in previous periods, was equivalent to the resources they had to make their purchases.

The simulated purchase environment included information on income and expenses in the current period in the upper left-hand side. It also contained information on savings, since, supposing that the participant did not spend all of the available income, it could be accumulated in the following periods.

Subsequently, the available products list was presented along with the price, quantity, photograph and name of each one. It was decided not to consider differentiations by brand in order to simulate the situation of the consumer who presumes the life cycle model in which goods are homogeneous. Participants could purchase each product by clicking on a shopping cart with a (+) symbol and could cancel it by clicking on another shopping cart with a (-) sign. They could also check the status of their purchases on an icon at the top right of the screen at any time during the session.

The repertoire of products remained at 30 during the first period and was expanded to 42 products later. From period 3 onwards, the use of credit for purchases with deductions at an interest rate of 10% was allowed in the following periods. It was inquired about the number of people in the participant's household to control their magnitude of purchases and previous credit experience.

Thus, the experimental condition can be summarized as shown in the Table 1.

Table 1

Summary of experimental conditions presented to participants

Number Period	**Life stage**	**Description**
1	Young	Baseline.
2	Young	Loss of purchasing power due to price increases.
3	Adult	Increased revenues, expanded producto repertoire. Credit introduction.
4	Adult	Increased revenues, loss of purchasing power due to price increases.
5	Retirement	Absence of income.
6	Retirement	Absence of income with loss of purchasing power.

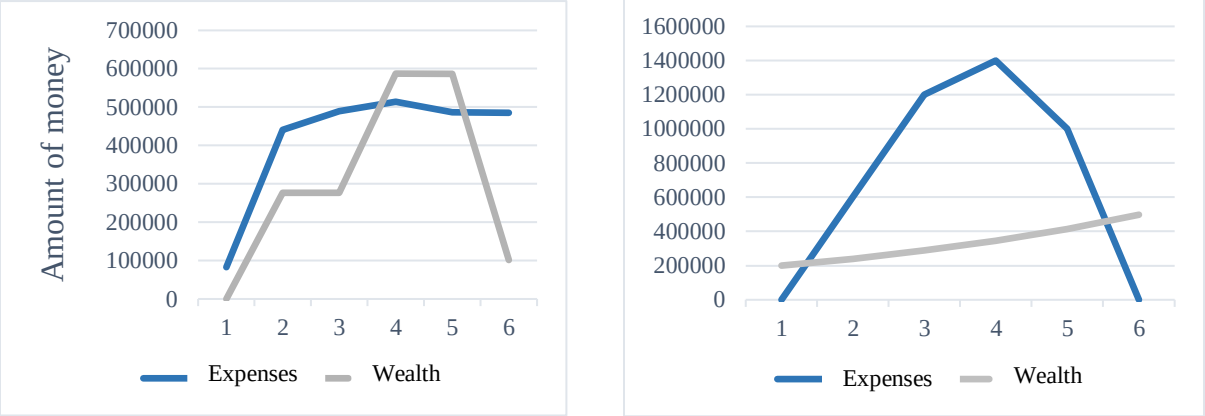
Source: own elaboration.

Analysis techniques

To process the information, a descriptive analysis exercise was carried out, which was focused on the variable income, expenditure and marginal propensity to consume for the entire sample, and filtered by characteristics such as gender and age ranges. Subsequently, these results were compared with the patterns observed for the case of two versions of the life cycle model, whose approximate visualization can be described as shown in Figure 1.

Figure 1

Expected spending/savings patterns differentiated by life-cycle model.



Source: own elaboration.

The values presented are hypothetical and they are expressed in amounts of money available as current income for the participants in the simulated exercise. The figure on the right shows a behavior close to the behavioral theory with increasing consumption patterns and even debt in the first stages, while the figure on the left shows a typical pattern of the standard theory with smoothed consumption and strong dissaving in the last two stages.

Results

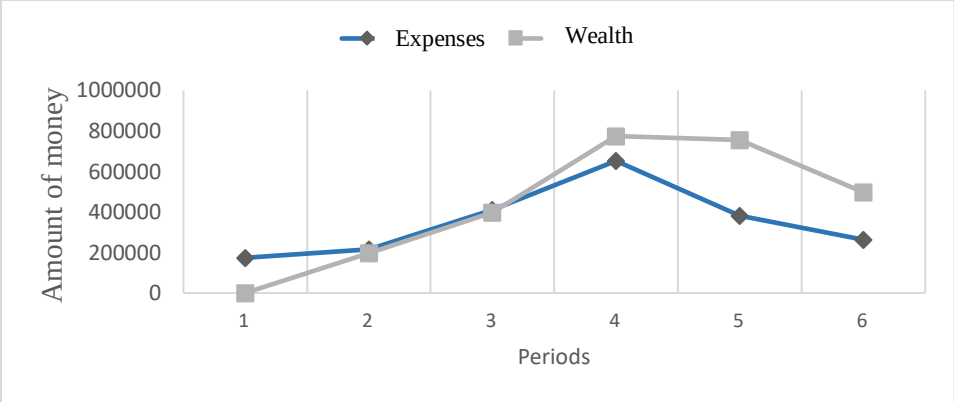
The analysis of the entire sample describes a pattern in which it is not possible to confirm the predictions of a single model. The observed data show little propensity to consumption smoothing as predicted by behavioral theory, while also recognizing a tendency to generate debt in periods 3 and 4. Likewise, it is evident that the disallowance is produced from the retirement phase onwards, a fact that is consistent with standard theory. Finally, it is important to note that although, at the macroeconomic level, in a pandemic context participants accumulated savings, the absence of consumption smoothing suggests that for the category of products included in the purchase task (family basket products) there is no reduction in spending.

In general, participants maintained savings throughout the year, which means that their wealth was not reduced to zero at the end of the period. Figure 2 shows the pattern of spending

and wealth for the entire sample, spending tends to respond to variation in income and wealth and does not remain stable over time; this fact indicate that the findings are more in line with behavioral theory.

Figure 2

Average life cycle for 210 participants.

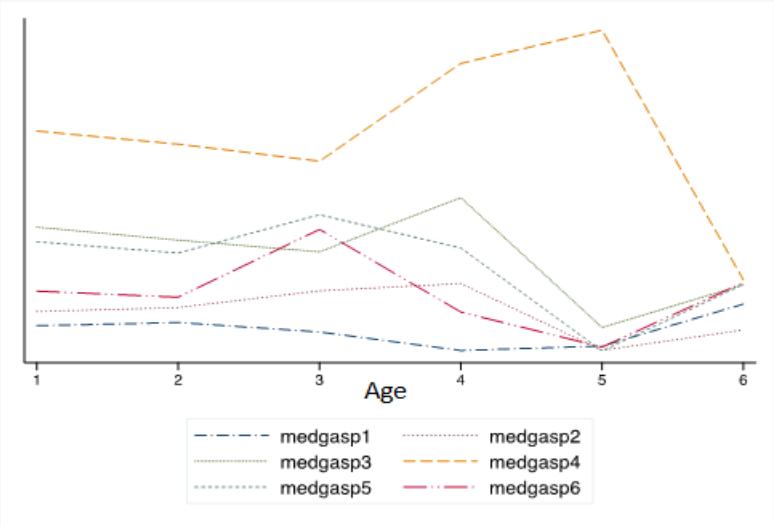


Source: Peak (2021, p 66).

Figure 3 shows the results of expenditure levels for each of the age groups in the six periods considered. The age groupings were as follows: 1 (18 to 25 years old), 2 (26 to 35 years old), 3 (36 to 45 years old), 4 (46 to 55 years old), 5 (56 to 65 years old), and 6 (over 66). The variables presented correspond in their order to the average expenditure for each of the periods, so the variable ‘medgasp’ is the average expenditure followed by the period number.

Figure 3

Average expenditure by age groups and periods



Source: own elaboration.

The results suggest that the lowest average expenditure was recorded in the first period and the highest in the fourth one. The finding is consistent with economic theory (Keynes, Modigliani, Brumberg, Shefrin and Thaler) since the fourth period has the highest current income in the simulation and, therefore, higher consumption expenditure can be anticipated. The 46-55 age group showed a tendency to higher levels of spending, while the most discrete ones were recorded in the 56 and older age group.

For age groups 1 and 2 (between 18 and 35 years old) a smaller bulge in spending patterns is observed in periods 3 and 4, meanwhile, in groups 4 and 5 the spending pattern consistent with income level coincides with previous results of Alessie & Ree (2009). These authors used Dutch data to show that around the age of 40 years old a bulge in spending patterns for non-durable goods is registered.

The greatest variations in the level of expenditure compared by age groups were recorded in period 6. Since while participants between 56 and 65 years old adjusted their consumption

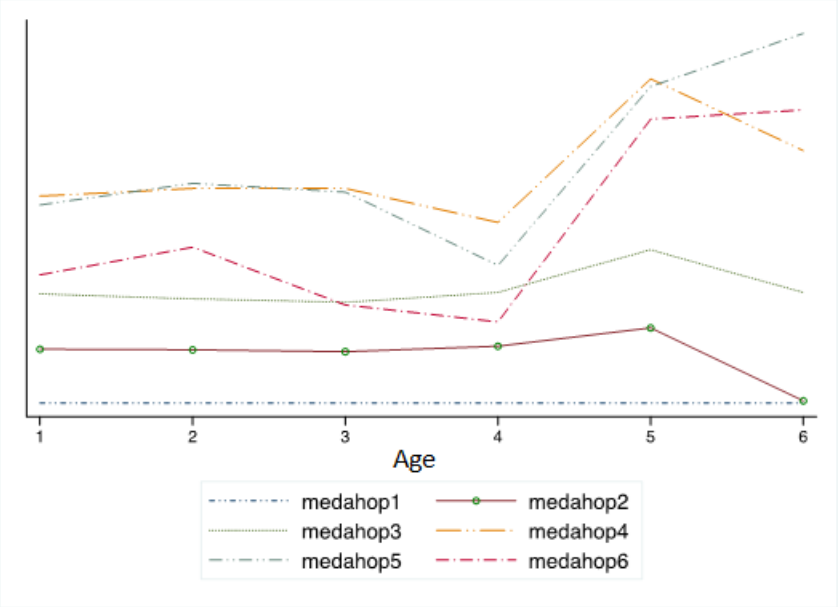
downward below $200.000, participants in group 3, who are between 36 to 45 years old, increased their consumption keeping it above $400.000.

Thus, the information shown in Figure 3 reveals that consumption depends on current income, since the highest expenditure averages were recorded in periods 3 - 4 and the lowest one in periods 5 – 6, and that age has an impact on consumption/saving patterns, because there is a difference in the response by periods for each age group. Likewise, atypical patterns are observed, such as increases in the volume of expenditure in period 2 with respect to period 1, despite the condition of loss of purchasing power that was introduced as a contingency in that period. This change may be due to the increase in the amount of goods available, a fact that suggests an eventual reduction in willpower, as predicted by behavioral theory.

As for savings behavior (see Figure 4), the data reveal a stable pattern for all age groups during period 2, and higher levels of savings in the three age groups over 46 for periods 4, 5 and 6. To this extent, it can be affirmed that the younger groups had a more marked tendency toward dissaving, a fact that confirms the predictions of behavioral theory and the previous findings of Green et al. (1994).

Figure 4

Average savings by age groups.



Source: own elaboration.

Since the age difference allowed us to recognize changes in the average of savings and spendings, it was considered prudent to propose an evaluation by sex for spending patterns. Thus, the variations in this variable were calculated by periods: from period 1 to 2 (difgas~1), from 2 to 3 (difgas~2), from 3 to 4 (difgas~3), from 4 to 5 (difgas~5), and from 5 to 6 (difgas~5), the results are presented in Table 2:

Table 2

Descriptive statistics of variations in spending by gender

Sex		**difgas~1**	**difgas~2**	**difgas~3**	**difgas~4**	**difgas~5**
Man	Average	30396,18	187967,4	287524,3	-307374,7	-104684,4
	Standard Deviation	182235,5	269182,6	338820,3	453013,9	292374

	N	89	89	89	89	89
Woman	Average	49317,83	201915,1	213816,8	-252805	-125920,7
	Standard Deviation	192948,4	296206,2	373950	469646,3	331177,3
	N	120	120	120	120	120
Total	Average	40754,05	195585,1	244094,7	-274782	-116300,4
	Standard Deviation	187941,1	283804,4	359922,8	461581,4	314040,4
	N	210	210	210	210	210

Source: own elaboration.

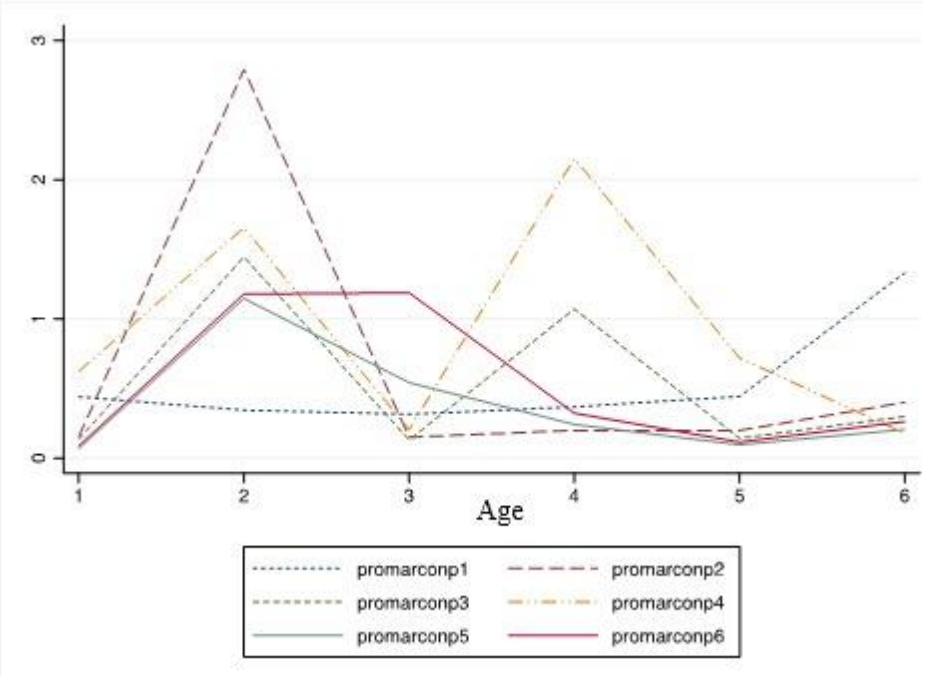
Between the first and second periods, women recorded a greater average variation in spending; this trend was repeated from period 2 to 4 and from 5 to 6. In the case of men, the variations were greater from periods 3 to 4 and from 4 to 5. These figures show that male participants were more sensitive to variations in current income. Despite this, there are no significant difference in the averages observed.

Lastly, it was considered important to observe the behavior of the marginal propensity to consume. As anticipated by theory, the marginal propensity to consume remained between 0 and 1 for the first period and close to levels of 0,5, implying that participants allocated half of their income to consumption and half to savings. One age group that deserves special attention is group 2, from 26 to 35 years old; in general terms, for the later periods (2 to 6) showed a bias towards indebtedness that is manifested in consumption levels that are above their current income and accumulated savings. Age groups 1 (18 to 25), 5 (56 to 65) and 6 (over 66) showed low propensity to consume with debt. The highest volatility, in terms of marginal propensity to consume, was observed in period 4, which also describes the setting with the highest current income.

Figure 5 presents the main findings for this variable by age group:

Figure 5

Marginal propensity to consume by periods and age groups



Source: own elaboration.

The findings presented in this paper suggest that individual consumption/savings patterns in the pandemic context were consistent with the behavioral theory in a higher proportion (85%). This fact confirms that there was a lower propensity to smooth consumption in the evaluated group, despite the restrictions and strict confinement to which the participants were subjected by the time the simulation was run.

In relation to previous literature, it can be noted that the experimental results show the effect of liquidity restrictions on consumption (Levin, 1998), since in periods with lower levels of current income, there was a smoothing of spendings. There are also slight effects on spending when the basket of goods is increased (period 2); i.e., there is partial evidence of conflict resolution between maker and planner of the behavioral theory in favor of the maker.

The results of the experimental simulation reaffirm the importance of principles such as those pointed out by Deaton (2005), regarding the effect of income on consumption and savings; the time with the greatest increase in income (period 4) was the one of greatest growth in consumption and savings. In terms of dissavings, the results are not decisive since, as Tobin (1967) anticipates, this is greater in the early stages; however, it was not possible to prove this same effect in the later stages, as previous behavioral studies have shown that dissavings does not occur in all cases in the later stages of the life cycle.

There was also a tendency to underwrite as Binswanger (2012) proposed in his model of bounded rationality with hierarchical objectives. It could be seen that there was a tendency to underwrite in the later periods to guarantee at least a portion of the consumption of the previous periods in the 6th, as well as an interest in maintaining consumption levels in retirement as shown by evidence from period 5. In the future, the weight of these effects can be explored experimentally to assess whether the tendency to maintain the consumption levels of previous periods outweighs the effect of loss aversion and insurance.

The collected observations verify microeconomic trends such as those seen in the works developed by Levin (1998) and Graham & Isaac (2002). However, it was not possible to verify this pattern for all participants, since 15% of them smoothed their consumption, behaving as predicted by standard theory. To this extent, it can be concluded along the same lines as Statman (2017), since individual financial behavior is consistent with both versions of the life cycle model.

Despite the macroeconomic trend observed in papers of Guglielminetti & Rondinelli (2021), Srivastava & Bhanot (2022) and Jin et al. (2021), in which respondents spend less on consumption and accumulated savings, the evidence obtained experimentally shows that most of the participants did not acccumulate savings in one of the most critical moments of the pandemic. Further work can investigate the causes of this behavior that coincide with the findings of DiCrosta et al. (2021), in relation to the high presence of anxiety and fear in the consumption of necessary goods in contexts of high uncertainty.

This conclusion is of course subjected to doubt, since in order to validate the changes in consumption/saving patterns, a contrast between these results and a simulation with the same participants under circumstances of elimination of circulation restrictions, to avoid the spread of the virus, can be proposed in future research.

On the other hand, it is worth noting that the experimental environment previously informed participants about the income conditions they would face in the future, which implied a greater margin to favor expense planning and ensure a minimum consumption level in all periods. Thus, although the data obtained reveal behaviors that are far from the standard of rationality proposed by the basic life cycle model, it is possible to recognize a savings dynamic that suggests a certain level of self-control on the part of the participants.

An additional element that should be reviewed in detail is the purchase response by groups of goods, since the degree of need for them (Menger, 2007) can reveal trends in consumption. Future research can concentrate on evaluating this dimension of the problem and establishing differentiations between the consumption of durable and non-durable goods, since previous work such as that of Alessie & Ree (2009), anticipates the existence of differences by age when establishing groupings between durable and non-durable goods.

However, if the dispersion in the price paid for different goods is recognized, there may be differences between consumption and expenditure, so it is necessary to review the divergence between consumption and expenditure by age, income and wealth profiles throughout the life cycle in future research, in accordance with the proposal made by Arslan et al. (2021).

Conclusions

The covid-19 pandemic led to alterations in consumption and saving levels, but did not produce a structural change in consumer behavior in intertemporal consumption settings in the case of basic food basket products.

This work verified through a simulation exercise of a virtual shopping environment that the tendencies to smooth consumption and increase savings were in the minority in the group

evaluated, and that the confinement context did not translate into more self-controlled intertemporal consumption behaviors.

The descriptive analysis presented shows that the two versions of the life-cycle model (the standard and the behavioral) have empirical validity, although the latter tends to better represent the behavior of a larger number of participants for the case of commodities. Future research can evaluate the effects of extending the product repertoire to other categories of goods, and investigate interventions that consider treatments that approximate the concept of willpower as proposed by behavioral theory.

The findings of this work allow us to propose a reflection on the nature of behavioral economics that does not focus solely on the identification of anomalies and deviations from rational behavior; its postulates can offer clues about more widespread behavioral patterns. However, in the case of the life-cycle model, its proposal does not constitute an analytical framework to replace neoclassical approaches.

Ethical considerations

The present study was carried out after evaluation by the ethics committee of the Institución Universitaria Politécnico Grancolombiano. This evaluation required the presentation of an informed consent that was socialized with the study participants. It was also informed about the objectives of the research, benefits, risks, procedures and persons in charge. Likewise, authorization was requested for the treatment of personal data, guaranteeing the anonymization of the data obtained.

Conflict of interest

The authors declare that there is no conflict of interest related to the article.

Authors' contribution statement

Claudia Milena Pico Bonilla: Conceptualization, Methodology, Resources, Visualization, Writing.

Luis Eduardo Sandoval Garrido: Software, Formal Analysis, Data Curation, Visualization, Writing.

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