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ORIGINAL ARTICLE

Viability of Universal Life insurance in Brazil from the supply and demand perspectives*

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ABSTRACT

The aim of this article was to evaluate the viability of Universal Life insurance (UL) in Brazil from two perspectives: from the individual viewpoint of policyholders, considering different client profiles and investment scenarios; and from the company viewpoint, verifying whether insurers see sales advantages in UL. Thus, despite the lack of definition of the regulations on these contracts by the Superintendence of Private Insurance (Susep), this article's contribution lies in evaluating UL – a typically American product – in Brazil, using an entirely actuarial methodology, for policyholders and insurers, according to local parameters. The relevance of the article lies in strengthening the support for individuals, companies, and authorities to evaluate the product and discuss its implementation, even identifying the most favorable profiles and scenarios for its development. Although the UL is an individual modality that is widespread in several countries and its design exploits well-defined attractions, the product has not been explored in the national literature. The methodology adoted in this study used fully actuarial modeling, the internal rate of return (IRR), and profit testing. The study reveals that the Brazilian market for UL is viable, especially due to the higher interest rates compared to countries where the product is already widespread. From a demand perspective, the results indicate that the policyholder would be in a more advantageous position acquiring UL than buying life insurance in the private market and investing the surplus in financial assets, due to the hybrid characteristic of the contract, which enables the use of financial returns as discount factors in the insurance portion and operational charges, reducing the opportunity costs linked to the product. With regard to companies, the profit testing results suggest there are stimuli for the supply of UL, provided the operation has a long-term bias. Altering the mortality pattern, policy type, and the company's investment profile, all the results point in a similar direction.

Keywords: Universal Life, life insurance, profit testing, actuarial, long-term investments.

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1. INTRODUCTION

Life insurance and long-term investments are two options whose main attraction is financial security, both for the contract holder and for the related beneficiaries. With relation to the first alternative, insurance guarantees financial protection in the case of occurrence of the covered events, through mutual bases and risk sharing. In the second case, individuals seek to acquire financial investment products as a way of placing their savings in investments that earn interest or other forms of return, with the aim of generating monetary resources, overcoming the effect of inflation, or increasing their patrimony to carry out personal projects.

Despite the common attribute – financial soundness – both alternatives have, however, some limitations: insurance is restricted to the so-called "benefit," so that the maximum financial receipt is previously known by the policyholders and is only accessed in the case of occurrence of the generating event; while investments, on the other hand, generally offer greater liquidity and return, but do not have the mitigation bias and transfer of financial onus derived from risks, which are typical of the insurance market.

In light of this context, Universal Life insurance (UL) emerged as a type of insurance that includes these two characteristics: insurance protection and financial investment, combining traditional life insurance with long-term accumulation. Besides the sharing of returns and redemption of investments, the attractiveness of the product is related to the flexibility of premiums and covers, given that the balance of the investment fund can be accessed at the time of the indemnity (composing, together with the death benefit, part of the benefit received in the event of a claim) and, depending on the amount accumulated, the policyholder may also be exempt from certain portions of the premium to be paid to the company.

UL is widespread in the United States of America (USA). According to research conducted in 2018 by Life Insurance Marketing and Research Association (LIMRA), the product accounted for an average of 37% of premiums collected in the country (Windsor, 2018). The size of the market is expressive, especially compared to traditional products from the individual life segment; also in 2018, whole life insurance represented 36% of annualized premiums, while temporary life insurance represented 21%. Also according to the LIMRA, it is estimated that, in the USA, life insurance accounts for more than USD 14 billion in transactions a year.

Despite the approximately 40-year history of its sale in the USA, in Brazil, however, the regulation of the product has not yet been concluded. In December of 2016, National Council of Private Insurance (CNSP) Resolution n. 344 was issued, approving the structure of the model in the country. Nonetheless, the Superintendence of Private Insurance (Susep) has not yet published the standards for UL. The discussion involves the dubious nature of the product, whose design places it between an insurance plan and a financial investment instrument, leaving pending matters related to tax questions and fiscal benefits.

The penetration opportunities for UL in the national market are linked to the limitations of temporary insurance (given that, after the end of the cover period, no accumulated value is available for redemption), to potential policyholders who only have a guarantee with a level premium, as well as to the possibility of retirement planning.

Therefore, in light of the singular design of the contract and given the discussion of it by the regulatory bodies, the main objective of this paper is to evaluate, from the individual viewpoint, the comparative advantage of buying this product in relation to the hybrid access between actuarial products – life insurance – and financial products, such as federal government bonds and stock portfolios. Subsequently, the evaluation is extended to insurance companies, in order to determine the attractiveness also from a company viewpoint and, thus, discuss the viability of creating a national market for UL. The analysis of the viability of UL in Brazil is warranted since the financial returns on investments in this country are higher than in countries where this product is widespread or has already been established, as is the case of the USA (Doll, 1999).

2. THEORETICAL FRAMEWORK

The product's creation in the USA occurred in the 1970s, when policyholders and potential insurers, concerned about inflation and rising taxes at the time, started to reassess their assets and investments – including

their life insurance policies – compromising the liquidity and stability of insurance entities. In this context, with the aim of presenting the market with a new and flexible design, UL was developed and launched as a combination between the benefits of traditional life insurance and the returns provided by an accumulation fund (Doll, 1999).

As a result of the widespread penetration of that design in the 1980s – due to the attractive interest rates credited in the policies – some studies were developed to verify their performance, especially from the individual viewpoint.

Chung and Skipper (1987) analyzed the relationship between the current interest rates and the projected values for redemption of a UL contract and concluded that this correlation would only be positive when considering long-term horizons (periods longer than 10 years). However, despite the interest rate being a relevant premise, Carson (1996) concluded that this may not be a primary determinant in the composition of the amounts earned by the product, especially in the short term. Thus, the author sought to explore the impacts of other variables – such as expenses, mortality rates, and redemption charges – on the constitution of the funds, and revealed that these effects are significant and negatively related with the values accumulated in UL. By disregarding these implications, it would be possible to extract erroneous market conclusions.

Expenditures associated with mortality and the other charges involved in an insurance operation were also elements addressed by Mitchell et al. (1999). The authors argue that, despite the expected present value of the payment of an annuity not equaling the premiums relating to the acquisition of the policy – given the loadings and charges of the offering company – policyholders would be willing to acquire this product instead of investing in an optimal investment strategy that did not include this protective characteristic.

In light of that, and considering the two aspects intrinsic to UL – protection and investment – Cherin and Hutchins (1987), Corbett and Nelson (1992), and D'Arcy and Lee (1987) sought to compare the design with other market investments capable of including the same components. Thus, under the initially adopted assumptions, Cherin and Hutchins (1987) reach the conclusion that an investor would be in a better financial position if they chose to acquire term insurance in the private market and invested the rest of what would be paid in the annual UL premium in the financial market than directly buying a product that included these two characteristics, given the administration fees and expenses inherent to the contract.

D'Arcy and Lee (1987) also report on comparing UL with similar resource allocation strategies. Here, however, the authors incorporate in their analysis the effects of taxes incurred on each one of the alternative strategies, exploring the tax advantages linked to the different acquisitions. According to the website of the Internal Revenue Service (IRS), the US tax authority, the returns on life insurance that a person receives as a beneficiary due to the policyholder's death are not included in gross revenue, so they are tax exempt. However, if some amount that has incurred interest is received by the policyholder while alive, this should be reported to the tax authority and taxed. Despite the charges derived from loading or redemption, the result obtained by D'Arcy and Lee (1987) favors, to some extent, UL: its tax benefits create scenarios in which the product represents the best purchase option in the market, providing the policy is in place for long enough (7 to 8 years' duration) and as long as the maximum capital allowed by law has been allocated in tax-free strategies.

Isolating the accumulation terms and return of UL, Corbett and Nelson (1992) compared only the cost of the protection element of the product with the premiums paid for renewable term insurance offered by the same insurer. The initial hypothesis is that, having observed major discrepancies between these values, the transparency premeditated by UL may not be complete or there could be other characteristics of the design that explained the high costs associated with it. The results confirm the divergences between the premiums going to the life insurance cover, but the authors stress, however, that caution is needed when generalizing this conclusion, since the sample used presented a wide variation of observed costs and the pricing essentially depends on the subscription process of the insurer analyzed.

The previous approaches study the behavior of UL and its viability observing the individual context. With regard to supply, Hoyt (1994) analyzes the cash flow of insurers that provide the product, introducing a predictive model for the financial dynamic of the firms. Gatzert and Kling (2007), in turn, investigate the risk component and the factors that affect return sharing policies – such as UL – covering measures such as variance and expected shortfall in situations in which the insurer does not adopt perfect hedge strategies in its operation.

Moreover, two recent papers address the question of costs and of pricing in the life segments: Koijen and Yogo (2015) analyze the markup in conditions of market imperfections, while Le Courtois and Shen (2018) apply the stochastic earnings test in policies with return sharing,

with the aim of examining the influence of parameters and financial models over the profit testing indicators of insurance companies.

In Brazil, there does not appear to be any academic references that explore the theme. Despite there being viability and competitiveness studies in the US market, whose empirical evidence shows that it would be more advantageous for potential policyholders to buy renewable term insurance than UL, or that the product would only be more attractive due to tax benefits after a maturity period of 7 to 8 years, it is not known for sure, from an individual viewpoint, if these conclusions obtained by the authors in the 1980s and 1990s are sustained and corroborated for the Brazilian case.

3. THE MODEL

Dickson et al. (2013) present the operational characteristics of UL and the calculations involving the financial transactions of the funds. In sum, it is a product that combines what would be whole life insurance with a variation of survival insurance, presenting three fundamental characteristics: transparency, flexibility, and return sharing.

Thus, the UL design is divided into two main components: the protection portion and the investment portion, the latter of which can be accessed, *a priori*, in three different ways: based on total or partial redemption by the policyholder; (ii) in the indemnity, composing part of the death benefit to be received by the beneficiaries in the event of a claim; and (iii) repaying returns on balances to cover premiums. It warrants mentioning the flexibility of the product here, since the values resulting from the investment portion can be transferred to the insurance component itself, reducing the amount of premiums needed to cover mortality. This may make the costing lower and/or non-continuous. Moreover, return sharing is formalized by the results associated with the interest on the operation, which in turn is linked to the financial performance of the investment funds held by the insurer. This dynamic is revealed to the policyholders in each period, ensuring monetary flow transparency.

With relation to the financial transactions of individual accounts, the premiums paid by policyholders are deposited in a notional (fictitious) account, which besides that component is also increased by the returns derived from financial investments. The deductions are related to mortality expenses and administration fees (AF), and the value of this account (AV) is dynamic in time, representing the company's responsibility to the policyholder.

There are two different modalities of UL contracts: type A and type B. The basic difference lies in the formula for calculating the benefit to be considered in the event of a claim. In type B contracts, the additional death benefit (ADB), which represents the amount agreed to cover death equivalent to the benefit that would be paid in the case of renewable insurance, is level and pre-determined, so that the AV tends to grow with time. Thus, the total death benefit paid is also expected to accompany this movement, precisely as it is the sum of the ABD and AV.

In the type A contract, in turn, the benefit follows a different logic: the total benefit is fixed, forcing a decrease in the ADB as the interest credited in the individual account stimulates its growth. Given that particularity, another specific characteristic of this modality is the existence of the so-called "corridor factor requirement," which aims to modulate the value of the insured amount (ADB) in cases in which the fund's performance provides major transfers to the individual accounts, which can thus match the actual total value paid in the claim – or even exceed it. In these situations, in order not to extinguish the ADB and thus maintain the insurance characteristic of the contract, the corridor factor guarantees a correction in the value of the protection portion, making it a function of AV. With this, the total benefit value may even exceed the value originally agreed, making the contract flexible not only in the contributive amount, but also in the redeemable amount.

The general mechanism of UL and the dynamics of its functioning structure are presented by Figure 1.

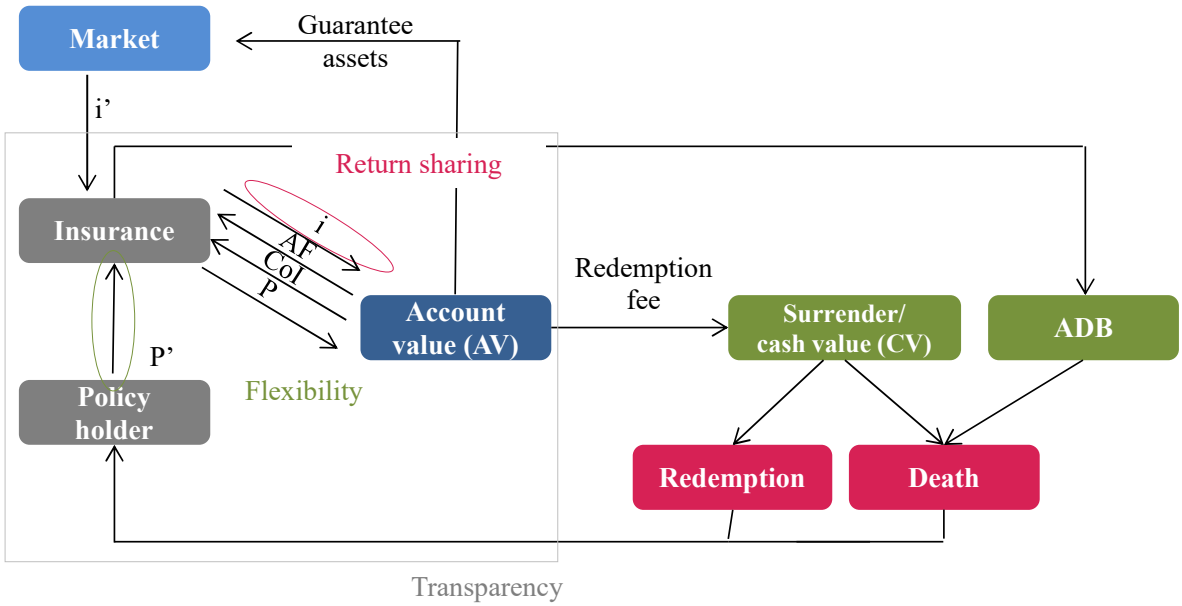

Figure 1 *Financial flows of Universal Life insurance (UL)*
ADB = additional death benefit.
Source: *Elaborated by the authors.*

The premiums (P') – contributive amounts paid by the participant in each time period – may be subject to a minimum value, but they are generally flexible. These values are paid to the insurance entity and transferred to the individual accounts (P). The AF can be a percentage of the AV, a proportion of the premiums, or even a fixed term, and the interest rates credited in the notional accounts (*i*) are the result of the performance of a financial investment portfolio defined by the company (with return *i'*), minus the spread. Finally, the cost of insurance (CoI) represents the pure single premium (PSP) for the one-year renewable term life insurance, with an insured amount equal to the ADB.

It warrants mentioning, however, that although the AV represents the insurance entity's responsibility in relation to the policyholders, this value does not necessarily match the one received by the policyholder in the case of redemption or a possible claim. This occurs because, given the costs inherent to the administrative operation, a decreasing redemption fee is incurred over time, which enables the company to retain part of the accumulated amount. This is a necessary mechanism to pay off (at least partially) the operational costs derived from the product in cases in which, due to the short time of the individual's permanence in the contract, the dilution of acquisition costs in long installments through the AF is not crystalized. Thus, after applying the fee, the new value of the account available for the individual is the surrender/cash value (CV), which can be accessed through redemption by the policyholder during their life or also in the event of a claim – composing, together with the ADB, the benefit value that goes to the beneficiaries.

The general structure of financial flows of the product presented by Figure 1 represents the workings of the US market. In the Brazilian model, proposed by CNSP Resolution n. 344/2016, there is the no corridor factor provision, as well as no formal differentiation between AV and CV, with both being contemplated by the mathematical provision for benefits to pay (PMBaC). In the Brazilian case, the value accumulated in the PMBaC can be redeemed, discounting any charges in arrears, if there is a provision in the product, and taxes. Moreover, in the case of a death benefit, (non-deferred) tax may apply, unlike in the United States. However, we should highlight the methodological choice of the US model design, adapting it to the idiosyncratic financial and biometric parameters of Brazil, because this concerns a mature market, whose workings, besides being known, enable a comparison with results from the literature.

The financial development of the AV (Brazilian PMBaC) is fundamental for understanding the relationship between the policyholder and the insurance company at each moment in time and is revealed in more detail in equation 1:

$$AV_t = \left(AV_{t-1} + P_t - AF_t - CoI_t\right) \times \left(1 + i_t\right), \qquad 1$$

for every $t \geq 0$, here, of annual periodicity.

4. METHODOLOGICAL PROCEDURES

4.1 Actuarial Aspects

With regard to the protection portion of the product, under the actuarial approach, the pricing of insurance products consists of an evaluation of random financial flows. In the specific case of insurance payable for death, so that the premium is minimally sufficient to cover these possible risk events, its calculation should respect equation 2:

$$A_x = \sum_{t=0}^{\infty} v^{t+1} \times {}_{t|}q_x \,, \qquad (2)$$

in which v^{t+1} is the financial discount factor at present value for $t+1$ years and ${}_{t|}q_x$ is the probability of the individual aged x dying between ages $x+t$ and $x+t+1$. A_x thus represents the PSP to be paid by an individual aged x for whole life insurance with a *post-mortem* benefit.

Another insurance modality payable for death is *temporary* life insurance ($A_{x:\overline{n}|}$). Unlike the previous case, in this situation the claim payment is only due if death occurs within a specific and pre-determined period n.

To obtain the actuarially fair premium, A_x is multiplied by the benefit amount stipulated in the policy. Another common adjustment for market practices is to transform this single-installment expenditure into annual level premiums, enabling policymakers smoothed payments in periodic quantities at a constant value, as according to equation 3:

$$\ddot{P} = \frac{A_x}{\ddot{a}_x} = \frac{\sum_{t=0}^{\infty} v^{t+1} \times {}_{t|}q_x}{\sum_{t=0}^{\infty} v^t \times {}_tp_x} \,, \qquad (3)$$

in which the subscripts of the A and $\ddot{a}$ terms depend substantially on the type of insurance taken out (whole, temporary, or deferred), as well as the modality and range of its payments.

4.2 Financial Aspects

Besides the insurance portion, another characteristic component of UL contracts is long-term accumulation. Unlike the actuarial evaluation, in this case the gains can be accessed independently of the generating death event, and the interest rates remunerate the amount allocated over time in proportions that depend on each investment type.

Observing the different risk profiles, two main investment modalities were considered: fixed income and variable income. In the first case, the proxy adopted for returns will be the remuneration of B-series National Treasury Bill (NTN-B) public debt securities, which present a mean real rate of return of 4% per annum (p.a.) – an approximation for public securities maturing from 2024 up to 2050 (http://www.tesouro.fazenda.gov.br) – indexed to the Extended Consumer Price Index (IPCA). For the variable income portfolio, in turn, we analyzed the returns derived from the stock market as an estimate of returns linked to the Bovespa Index (Ibovespa), which portrays the average performance of quotations through a theoretical and representative portfolio of the most traded stocks on the B3 S.A. – *Brasil, Bolsa, Balcão* (B3).

Given that the Ibovespa expresses nominal returns, it is necessary to also use, in each period, the expected nominal return from fixed income operations, considering the real interest rate of 4% p.a. This enables both returns to be compared and subjected to a sensitivity analysis, considering each investor's risk profile.

4.2.1 Inflation and Ibovespa estimates

For inflation in the next periods, we will adopt the goal defined by the National Monetary Council (CMN), which uses the IPCA when calculating this indicator. For 2020, a cumulative rate of 4% was reported, foreseeing a tolerance interval of 1.5 percentage point above or below. This 4% p.a. rate is also accompanied by the Focus Report, which presents the market's expectations for some economic indices and is published weekly by the Central Bank of Brazil (BC).

In contrast, in relation to the financial market, the Ibovespa return will be estimated based on the historical evolution of its returns, considering the closing values of the B3 between January of 2000 and December of 2018, in which the mean return observed for the stock index was 12.3% p.a. The standard deviation considered, in this case, will be 8 percentage points above or below.

Given these specific estimates, as well as their corresponding deviations, it is possible to build some scenarios that incorporate these values and that ultimately represent the expected return linked to the different combinations of the return from the fixed income (NTN-B and inflation) and variable income (Ibovespa) markets.

Based on this baseline scenario (8.16% p.a. return in fixed income and 12% p.a. in variable income operations,

both nominal), increases in the returns on the portfolio are thus foreseen as positive displacements occur in each one of the individual returns on the investments, with the opposite occurring when there is a fall in the interest rates associated with both investments. It is noted that, despite the impossibility of negative returns (due to the construction used; after all, deflation is not expected in the Brazilian economy) derived from the fixed income operations, this scenario is likely to occur in the variable income investments, suggesting that the guarantee assets allocated in this modality may be subject to devaluation.

4.3 The Product

Combining the actuarial and investment characteristics presented, the UL is developed in a notional account (the AV) for each policyholder over time, as shown by equation 1. Given the distinction between the two policy types (A and B), the calculation of the terms relating to the movement of the AV_t will be partitioned between these two categories.

With regard to the tax benefits derived from the financial gains obtained with the product, as Susep had not standardized UL up to the time this text was written, these aspects will be disregarded in the individual account evaluations. However, it is important to highlight that this specificity, as soon as it is defined by the national regulator, could influence not only the models adopted and the results, but also the incentives that economic agents will have to sell UL.

4.3.1 Type B policy

In this policy type, the total value paid in the case of a claim increases in every analysis period given a fixed ADB and supposedly rising AV over time. To calculate the dynamic of the individual accounts, four variables will be considered: the CoI, the premiums, the administration fees, and the interest rate on the assets in the investment account.

With relation to the insurance protection of equation 1, we have:

$$CoI_t = A_{x+t:\overline{1}|} \times ADB_t, \qquad 4$$

in which CoI_t reflects the PSP that would be paid by the individual in the private market by one-year renewable temporary life insurance.

Given this first component, the premiums to be paid by the policyholder (P_t) include the CoI_t (the actuarially fair premium) and another two incremental installments: (i) the additional loading margin to pay off the administrative costs of the operation; and (ii) the volume used for the investment portfolio.

The operational administration fees (AF_t) adopted in equation 1 were fixed at 1% over the value of the premiums collected plus an additional monetary amount. This is an amount used to cover various operational expenses of the insurance product management.

Finally, in relation to the interest credited in the AV from equation 1, i_t, the estimated rate is linked to the composition of the investment portfolio adopted by the insurance company. The relationship between the fund manager's risk profile and the percentage allocated in each investment class – in compliance with the legal limits, according to which at least 51% of guarantee assets should be invested in the fixed income modality, as defined by CMN Resolution n. 4,444/2015 – adopted in this study will be the following: if the company adopts a conservative approach, 80% of assets are invested in fixed income. If it decides on a moderate profile, then 60% of the resources generated will be invested in federal government bonds.

After a certain initial resource allocation – a discretionary factor that can be simulated – the remuneration associated with each asset class is calculated as shown in section 4.1, following the dictates of Art. 39 of CNSP Resolution n. 344/2016. In Brazil, the return on the PMBaC balance is linked to the performance of Specially Constituted Investment Funds (FIE), whose legal limits are given by CNM Resolution n. 4,444/2015. It is assumed that the insurer charges a spread for the decision to diversify investments, aiming to maximize the return earned by the FIE, so that the interest credited in the individual accounts is the rates of returns resulting from the investments minus the spread.

4.3.2 Type A policy

In this policy type, unlike the previous case, in which the total benefit reflected the movement of the AV (as the ADB was constant and pre-determined), the value due in the event of a claim – also referred to as the face amount (FA), that is, the sum of the insurance and the financial accumulation portions paid in the case of the policyholder's death – is fixed, so that the ADB_t tends to decrease over time due to the growth in the value of the individual account AV_t. The relationship between these values is shown in equation 9.

The way of calculating AF_t, i_t, and P_t is similar to the type B policy. However, the CoI_t and ADB_t values are estimated in another way, due to the inclusion of the corridor adjustment factor γ_t (as indicated in equation 10). As explained in section 3, this factor guarantees the preservation of the insurance characteristic of UL in

cases in which the gains earned with the interest on the portfolio promote the accelerated growth of the individual accounts, which thus come to represent a major portion (or the entirety) of the total benefit.

Assuming the same interest rate i_t and considering that subscript c indicates the application of the adjustment factor and f denotes that the incidence of that factor is not admitted, we have:

$$CoI_t = \max\left(CoI_t^f, CoI_t^c\right) \quad (5)$$

and

$$ADB_t = \max\left(ADB_t^f, ADB_t^c\right), \quad (6)$$

in which

$$CoI_t^f = A_{x+t:\overline{1}|} \times ADB_t^f = \frac{A_{x+t:\overline{1}|} \times \left[FA - \left(AV_{t-1} + P_t - AF_t\right) \times \left(1+i_t\right)\right]}{1 - A_{x+t:\overline{1}|} \times \left(1+i_t\right)}, \quad (7)$$

and

$$CoI_t^c = A_{x+t:\overline{1}|} \times ADB_t^c = \frac{A_{x+t:\overline{1}|} \times \left(1+i_t\right) \times \left(\gamma_t - 1\right) \times \left(AV_{t-1} + P_t - AF_t\right)}{1 + A_{x+t:\overline{1}|} \times \left(1+i_t\right) \times \left(\gamma_t - 1\right)}. \quad (8)$$

Moreover:

$$ADB_t^f = FA - AV_t, \quad (9)$$

$$ADB_t^c = \left(\gamma_t - 1\right) \times AV_t. \quad (10)$$

Based on the development of these models and the consequent attribution of values to AV_t, the evaluation of the commercial viability of the product, from both the company and individual viewpoints, can be carried out based on the metrics that will be covered in the next section.

4.4 Assessment Metrics and Viability

4.4.1 Demand

From the individual viewpoint, the metric adopted to verify the comparative advantage of UL in relation to other combined insurance and investment options will be the IRR, also used by Cherin and Hutchins (1987).

Given that the policyholders have the option of investing in the private market the premium that would be spent on the hybrid product, this is an indicator that ultimately enables an evaluation, from a demand viewpoint, of whether the individual would be in a better position acquiring UL or buying renewable temporary life insurance in the market and applying the surplus in portfolios or investment funds that offered similar benefits and risks to UL. This is possible through the direct comparison of the return linked to these two alternatives, with the IRR being obtained through equation 11:

$$VPL = \sum_{t=0}^{T} \frac{FC_t}{\left(1+IRR\right)^t} = 0, \text{ in which } FC_t = -\left(P_t - CP_t\right), \text{ if } t \neq T \text{ and } FC_t = CV_t, \text{ if } t = T, \quad (11)$$

with CP_t representing the commercial premium of temporary life insurance available in the market. To estimate it, equation 12 was used to incorporate into the actuarially fair premium (CoI) the sum of the charges and fees of the operation (k).

$$CP_t = \frac{CoI_t}{(1-k)}. \quad (12)$$

In the specific case of UL, consistently with the paper by Cherin and Hutchins (1987), the entries considered will be the premiums paid at each point in time by the policyholder minus the average commercial premium practiced by the private market for one-year temporary life insurance. This creates a fictitious investment scenario for the individual, who receives, after the time of permanence with the contract, an amount of return equal to the cash value. In this particular case, the IRR thus represents the opportunity cost linked to the policyholder's permanence in the UL.

4.4.2 Supply

Despite the IRR revealing the potential penetration of UL in the market, its analysis is restricted to the individual perspective. Thus, it also is necessary to evaluate the viability of the product from the company viewpoint, in order to verify whether insurance entities see a potential sales opportunity in UL.

The assessment metric adopted, in this case, will be profit testing, also used by Dickson et al. (2013). The method consists of evaluating the insurance company's result in each time period and verifying the moment at which the so-called payback of the operation occurs (the moment at which the returns on the product are enough to pay off the initial amounts used to carry out the project). The execution is developed in two stages. First, the earnings vector of company Pr_t is calculated, as presented by equation 13:

$$Pr_t = AV_{t-1} + P_t - F_t + I_t - EDB_t - ESB_t - EAV_t, \quad (13)$$

in which AV_{t-1} represents the individual account value at time *t-1*, P_t is the premium paid by the individual in *t*, F_t are the insurer's overall administration fees, not necessarily equivalent to AF_t from equation 1 (that is, part of the earnings earned by the insurer is already recorded and incorporated in individual expenses, together with the other costs linked to the policies), and I_t denotes the rate that represents the total return obtained by the company on its investment portfolio. EDB_t, ESB_t, and EAV_t portray, respectively, the three possible movement scenarios of the AV_t in each time period *t*: (i) death of the policyholder; (ii) redemption of the cash value; and (iii) continuity of the account. In the first case, the expected value of the death benefits paid at the end of the *t*-th year (EDB_t) is the probability of the individual's death between *t-1* and *t* multiplied by the total value paid in the event of a claim ($AV_t + ADB_t$), plus the additional expense incurred on the policyholder's death. In the second situation, the expected cost of the benefits redeemed in *t* (ESB_t) is the surrender value in *t* plus an additional value also related to the transaction costs, weighted by the probability of redemption in *t*. Finally, in the last scenario, the expected value at the end of the *t*-th year for the accounts that continue active (EAV_t) is the AV_t multiplied by the probability of the individual's permanence with the product.

Given the creation of the earnings vector through equation 13, the second stage of developing the profit testing consists of multiplying the values of that vector in *t* by the probability of the policy being in effect at the start each period:

$$\pi_t = Pr_t \times p^{00}_{x+t-2} \times \left(1 - p^{0d}_{x+t-1} - q^{0w}_{x+t-1} + p^{0d}_{x+t-1} \times q^{0w}_{x+t-1}\right), \quad (14)$$

in which p^{00}_{x+t-2} is the probability of the policy being in effect up to time *t-1*, p^{0d}_{x+t-1} is the probability of the individual not dying between *t-1* and *t*, and q^{0w}_{x+t-1} refers to the probability of redemption between *t-1* and *t*. Subsequently, to find the net present value of earnings (NPV_t), a discount of j_t is applied on π_t and the value found with NPV_{t-1} is added:

$$NPV_t = \pi_t \times (1 + j_t)^{-t} + NPV_{t-1}. \quad (15)$$

Thus, we have the stochastic nature of NPV_t representing the result of the operations in each analysis period and, at the time when there is inversion of the sign and the values become greater than 0, the payback of the UL product is observed.

5. RESULTS

5.1 Hypotheses and Premises

Given the structure of the model and the methodology described in sections 3 and 4, the premises adopted for the operationalization of the calculations are presented in Table 1.

Table 1
Premises for the calculation of the individual accounts and assessment metrics of Universal Life insurance (UL)

General criteria	
Mortality table	AT-2000 and BR-EMS 2015-mt, segregated by sex
Sex	Men/women
Age when contracting the product	20 to 60 years old
Percentage invested in fixed income	60 and 80%
Return on the fixed income products (real + inflation)	6.60, 8.16, and 9.72% p.a.
Return on the variable income products	4 to 20% p.a.
Policy duration	5 to 20 years
Specific criteria - policyholder	
Initial premium	R$ 2,250.00
Duration of the premium	100% of the period the contract is in effect
Additional death benefit (ADB) – Type B	R$ 100,000.00
Face amount (FA) – Type A	R$ 100,000.00
Standard mortality percentage	100%
Administration fees (AF)	1% of the premium + R$ 50.00
Turnover table	Dickson et al. (2013, pp. 449-457)
Specific criteria - insurer	
Initial expense of the operation	R$ 2,000.00
Expenses incurred in renewing the policy	1% of the premium + R$ 45.00
Spread over the returns obtained in financial investments	2%
Expenses incurred in the claim	R$ 100.00
Expenses incurred on redemption	R$ 50.00
Discount rate	2%
Specific criteria - market	
Loading factor over the actuarially fair premium (k)	30, 40, and 50%

Source: *Elaborated by the authors.*

From the policyholder's viewpoint, the initial premium is at annual bases and was considered constant for all the years in which there was disbursement (100% contributive density). Together with the ADB_t, standard mortality percentage, AF_t, and turnover hypotheses, these premises are related with the representative individual and are used to enable the development of the individual account AV_t, in conformity with equation 1.

The premises linked to the context of the insurer, in turn, generally relate to the charges incurred by the entity in its own operation. The initial and administrative expenses are linked to the possible movements of the individual accounts and were recorded based on the hybrid costing (percentage of the premiums and additional monetary value) and fixed amount models. To enable the develop of the profit testing accounts, we assumed a 2% spread over the returns obtained on the financial investments and a 2% discount rate for assessing the annual results, reflecting the expected growth of Brazilian gross domestic product (GDP). The choice of this discount rate was based on the results of the editions of the BC Focus Report from mid-October of 2019, when the paper was conceived. The expected growth was maintained at that level for at least five weeks.

For empirical exercise purposes, we adopted the same turnover table used by Dickson et al. (2013, pp. 449-457) to incorporate the situation in which the policyholders' access to the surrender value does not originate from a claim, but rather through redemption in life. The values derived from that table therefore represent the expected percentage of policies redeemed at the end of each additional year of the contract's duration and are used to compose the ESB_t, whose effect can be directly observed in the earnings vector of the insurance company. Following the same criteria as the authors, we also used the penalty rates for early redemption and the corridor factor adjustment.

With relation to the k factor – reflecting the transfer of expenses of the operational management itself to the commercial premiums, according to equation 12 – three different values were adopted depending on the

individual's age group: 0.5, 0.4, and 0.3 for the ages of 20, 40, and 60 years old, respectively. The choice of decreasing levels according to age is a way of preserving the format of the original actuarially fair premiums curve, which naturally rises according to the greater probability of death. If a constant factor was applied for all ages, an exponential distortion would be created in the dilution of costs by age: the youngest group would incur lower operational costs, as the actuarially fair premiums for that group are naturally lower, and the highest costs would fall on the oldest group of policyholders, which initially have very high associated premium values and, for that reason, would be less willing to incur even higher expenses.

While the specific criteria are defined and fixed in the results analyses, the general criteria of Table 1 represent the factors used in assessing the sensitivity of the results in relation to the characteristics of the policyholder and of the market context the company is part of. This ultimately enables us to identify the scenarios in which UL is more attractive for the potential participants in this market.

5.2 Results – Individual Perspective

5.2.1 Baseline scenario

Attributing the premises presented in Table 1 to equation 11, we obtain the results associated with the individual evaluation metric presented in the paper. Initially adopting the AT-2000 mortality table and considering as a representative individual an insured man taking out the type B policy at 40 years old who remains with the product for 10 years, earning the expected returns on each investment and allocating 80% of assets in fixed income – the baseline scenario – the nominal IRR obtained with UL is 9.10% p.a.

5.2.2 Sensitivity analysis – Simulation of new scenarios

Beyond the baseline scenario, the IRR values for the various combinations of policyholder profiles, market returns, and contract characteristics for a type B policy – according to the general criteria of Table 1 – are shown in Table 2.

Table 2

Internal rate of return (IRR) for type B Universal Life insurance (UL) for different sexes (S), contracting ages (Ag), and policy duration (D), considering 80% of assets invested in fixed income

S	Ag	D	Fixed income return (%)								
			6.6			8.2			9.7		
			Variable income return (%)								
			4.0	12.0	20.0	4.0	12.0	20.0	4.0	12.0	20.0
M	20	5	4.1	6.6	9.0	6.0	8.4	10.8	7.9	10.3	12.7
		10	5.6	7.4	9.2	7.0	8.8	10.7	8.4	10.3	12.1
		20	4.7	6.4	8.1	6.0	7.7	9.4	7.3	9.0	10.7
	40	5	4.1	6.5	9.0	6.0	8.4	10.8	7.9	10.3	12.7
		10	5.9	7.7	9.5	7.3	9.1	10.9	8.7	10.5	12.3
		20	5.2	6.8	8.4	6.5	8.1	9.7	7.7	9.4	11.0
	60	5	5.4	8.1	10.9	7.5	10.3	12.9	9.7	12.4	15.0
		10	9.7	11.4	13.1	11.0	12.7	14.4	12.3	14.1	15.8
		20	10.2	11.2	12.3	10.9	12.0	13.2	11.8	13.0	14.2
W	20	5	3.8	6.2	8.6	5.7	8.1	10.5	7.5	9.9	12.3
		10	5.3	7.1	9.0	6.7	8.6	10.4	8.2	10.0	11.9
		20	4.6	6.3	8.0	5.9	7.6	9.3	7.2	8.9	10.6
	40	5	3.9	6.3	8.7	5.7	8.2	10.6	7.6	10.0	12.4
		10	5.5	7.3	9.2	6.9	8.8	10.6	8.4	10.2	12.0
		20	4.8	6.5	8.1	6.1	7.8	9.4	7.4	9.1	10.7
	60	5	4.2	6.8	9.3	6.2	8.8	11.3	8.2	10.8	13.3
		10	7.2	9.0	10.8	8.6	10.4	12.2	10.0	11.8	13.6
		20	6.7	8.1	9.6	7.8	9.3	10.8	9.0	10.5	12.0

Note: *The redder, the lower the IRR; the greener, the higher the IRR.*
Source: *Elaborated by the authors.*

It is verified in Table 2 that the highest values of the indicator are mostly concentrated in the situations in which the financial returns derived from the funds managed by the company are substantially high. In these scenarios, the IRR of the contract generally exceeds the rate of return that would be obtained if the individual took out term life insurance in the private market and invested – directly and without the intermediation of an agent or company – in the same portfolio of investments adopted by the insurer (in the baseline scenario, for example, the rate of return obtained by the individual in the private market would be 8.93% p.a.). This advantage occurs because the interest credited in the policyholder's accounts behaves as discount factors on the values and loadings that would be paid in the individual insurance.

Moreover, varying the percentage allocated in each of the investment types, it is noted that the attribution of a higher proportion of the fund to fixed income securities generally ensures greater stability of the results – a situation association with the high variance of historical returns observed in the stocks traded on the B3.

With regard to the individual characteristics, the variations in the IRR according to the participant's sex and their respective entry age are strongly related with the utilization of the discount effects derived from the interest credited in the notional accounts. This effect is even more evident when the commercial premiums practiced in the market are higher. It is also observed that women ordinarily have lower IRR values than men, given their higher life expectancy and, consequently, lower insurance premium to be spent in the private market.

Following the same criterion and isolating the other factors, an increase in the entry age monotonically increases the result of the operation: 60-year-old individuals, whose premiums in the market are substantially higher, are able to offset a large portion of the insurance costs with the returns derived from the investment funds themselves, while for younger ones (20-year-old entry age) this effect is not expressive. Moreover, an important characteristic of UL stands out here: the possibility of maintaining the same value of insured amount (ADB_t) based on constant and level premiums. For example, it is noted that, in the case of 60-year-old policyholders, there are times at which the UL premium (R$ 2,250) would not be enough to, on its own, cover the rising cost that would be paid in the private market, aiming to maintain the fixed insured capital of R$ 100,000.00. Due to the hybrid design of the product, however, it is possible to continue with that same benefit paying a constant quantity, due to the historical interest accumulated in the individual accounts.

Finally, in relation to the duration of the policies, an optimal IRR level is found at an 8-year contract duration, similar to the results of D'Arcy and Lee (1987). This is a period in which the effects of penalties for early redemption, rising costs of the insurance portion, and accumulation of interest derived from investments are balanced.

The IRR values associated with the investment of 60% of assets in fixed income were not shown for questions of space, as well as due to the similarity with the results obtained based on the use of 80%. Moreover, we carried out other simulations besides those shown in tables 2 and 3. If the reader is interested, the other results can be provided by the authors on request.

Figure 2 presents the marginal effects linked to the variation in each one of the characteristics presented in the general criteria of Table 1. Based on the baseline scenario covered in the previous section, an IRR can be obtained for every new situation by individually altering each one of the variables described. In this second analysis, besides the change in mortality pattern (BR-EMS2015-mt table, reflecting the Brazilian experience), we considered new contacting ages, policy duration, and return on variable income investments – even incorporating the possibility of devaluation of the invested capital. Despite the AT-2000 table being used for survival covers and the BR-EMS-mt one being adopted for death covers, the results are comparatively less sensitive to this variable, so that choosing the AT-2000 table (conservative, in this case) does not lead to distortions in the results. Based on the baseline scenario, the most sensitive variables in the composition of the result are the return on variable income, the return on fixed income, the percentage allocated in fixed income, the initial age when taking out the policy, and the duration of the policy.

All the simulations carried out for the type B contract were replicated for a type A contract. However, the IRR results for that case, despite being lower – due to the lower cost of the portion relating to the death plan that would be paid in the private market (influenced by the growth of the individual accounts and of the total fixed benefit) – still continue to be very similar to the outputs of the policy adopted in the baseline scenario.

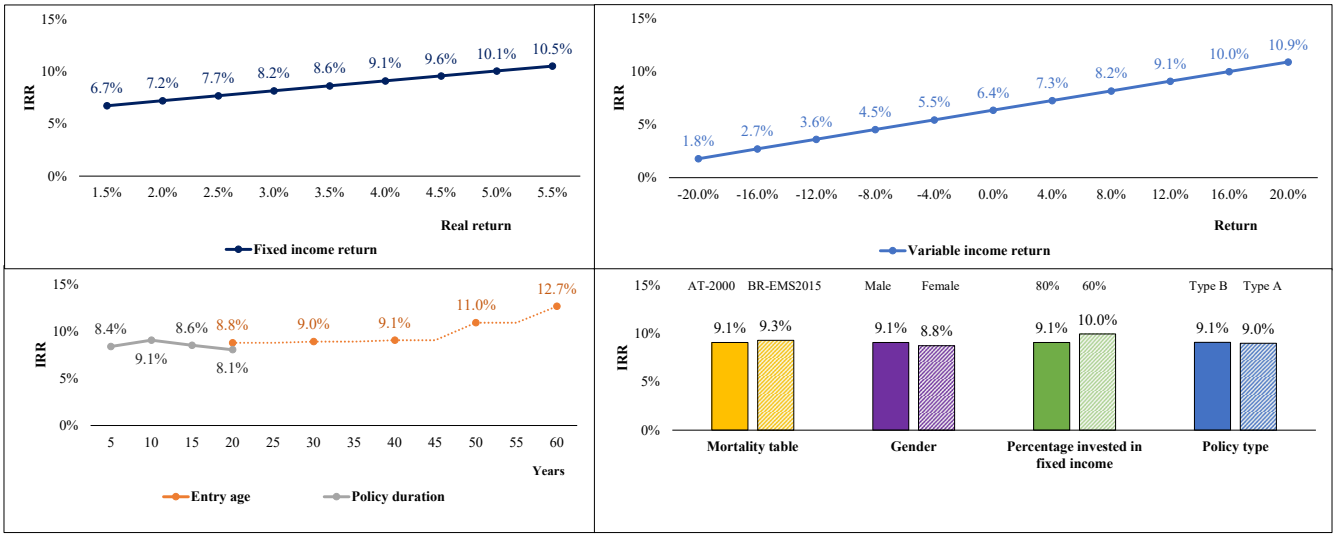

Figure 2 *Marginal effects of the variables linked to the composition of the internal rate of return (IRR)*
Source: *Elaborated by the authors.*

5.3 Results – Company Perspective

5.3.1 Baseline scenario

Considering the same baseline scenario described in the previous subsection, the result of the operation, from the company perspective, suggests the possibility of selling the product: the expected earnings for the company, with a subscribed policy and after 10 years of contract with the representative individual, is approximately R$ 701. The payback of the business is verified after the first 9 years in effect, suggesting that the insurers' interest is greater for long-lasting contracts.

5.3.2 Sensitivity analysis – Simulation of new scenarios

This section presents the monetary results of the insurance company offering UL for the same profiles adopted in the IRR evaluation. The estimated values for the earnings vector of the profit testing are shown in Table 3.

Table 3
Profit testing (in R$) for type B Universal Life insurance (UL) for the different sexes (S), contracting ages (Ag), and policy duration (D), considering 80% of assets in fixed income

S	Ag	D	Fixed income return (%)								
			6.6			8.2			9.7		
			Variable income return (%)								
			4.0	12.0	20.0	4.0	12.0	20.0	4.0	12.0	20.0
M	20	5	-988.00	-973.00	-957.00	-976.00	-961.00	-945.00	-964.00	-948.00	-932.00
		10	577.00	677.00	782.00	654.00	758.00	869.00	735.00	844.00	960.00
		20	3,084.00	3,502.00	3,977.00	3,406.00	3,867.00	4,393.00	3,761.00	4,271.00	4,853.00
	40	5	-998.00	-983.00	-967.00	-986.00	-971.0	-955.0	-974.0	-958.0	-942.0
		10	522.00	621.00	725.00	598.00	701.00	811.00	678.00	786.00	901.00
		20	2,839.00	3,241.00	3,696.00	3,148.00	3,591.00	4,095.00	3,489.00	3,979.00	4,537.00
	60	5	-1,167.00	-1,151.00	-1,135.00	-1,155.00	-1,139.00	-1,122.00	-1,142.00	-1,126.00	-1,109.00
		10	-94.00	-14.00	70.00	-32.00	51.00	140.00	32.00	120.00	214.00
		20	963.00	1,229.00	1,534.00	1,168.00	1,463.00	1,802.00	1,395.00	1,723.00	2,100.00

Table 3
Cont.

S	Ag	D	Fixed income return (%)								
			6.6			8.2			9.7		
			Variable income return (%)								
			4.0	12.0	20.0	4.0	12.0	20.0	4.0	12.0	20.0
W	20	5	-982.00	-966.00	-950.00	-969.00	-954.00	-938.00	-957.00	-941.00	-925.00
		10	604.00	704.00	811.00	682.00	787.00	899.00	763.00	874.00	991.00
		20	3,155.00	3,579.00	4,062.00	3,481.00	3,950.00	4,483.00	3,842.00	4,360.00	4,950.00
	40	5	-991.0	-975.0	-960.0	-979.0	-963.0	-947.0	-967.0	-951.0	-934.0
		10	565.00	665.00	770.00	642.00	746.00	857.00	723.00	832.00	948.00
		20	3,018.00	3,433.00	3,905.00	3,337.00	3,796.00	4,317.00	3,690.00	4,196.00	4,774.00
	60	5	-1,084.00	-1,068.00	-1,051.00	-1,072.00	-1,055.00	-1,037.00	-1,058.00	-1,041.00	-1,024.00
		10	185.00	273.00	367.00	253.00	346.00	444.00	325.00	422.00	526.00
		20	1,848.00	2,183.00	2,564.00	2,105.00	2,476.00	2,899.00	2,390.00	2,801.00	3,272.00

Note: *The redder, the lower the results of the profit test; the greener, the higher the results of the profit test.*
Source: *Elaborated by the authors.*

It is noted that, despite the directly proportional relationship between earnings and the returns earned in the application of the financial resources, the returns exert less influence on the results if compared with the policyholder's entry age and policy duration. This derives from the fact that: (i) due to the rising mortality rates over time, and with the fixed initial value of the premium paid, the later the individual's acquisition of the UL, the greater the provisions will be that the company should constitute to pay off possible claims (EDB_t); and (ii) as a characteristic of the insurance market, high fundraising costs are incurred in the first period of the contract, with a longer time horizon being needed for the entity to start to offset the initial expenses. Moreover, the accumulation of resources derived from the individual accounts for a longer period enables the company to achieve greater earnings due to the spread retained on the investments.

The best earnings scenarios are, therefore, linked to the longer-lasting policies (between 10 and 20 years) and lower entry ages of their respective policyholders (approximately 20 and 40 years old). Women provide slightly better results due to their greater life expectancy.

From analyzing the performance of the type A policies from the firms' perspective, it is verified that it is more advantageous for the insurer to sell type B policies, since, due to the particular dynamic of that contract, the cost of a life insurance policy (CoI) of that modality is generally lower, thus providing greater values available for redemption compared to the type B policy. Moreover, as the adjustment factor ensures a relationship between ADB and AV in cases in which good fund performance promotes expressive growth of the notional accounts, the total benefit value due in the case of a claim is added in those circumstances, increasing the value of the provisions.

Combining the results of Tables 2 and 3, it is possible to determine the most sensitive variables to the results and, consequently, the most advantageous conditions for the sale of UL in Brazil: (i) high returns on fixed income and variable income investments (equal to or above expected) – a dominant factor from the individual perspective; and (ii) longer-lasting policies (contracts lasting between 10 and 20 years) – a dominant factor from the firm's perspective. It is therefore concluded that the best scenario materializes when high financial returns are observed and that, in general, the potential policyholder of that product is typically an older individual, with prospects for long-term permanence in the UL.

5.4 And if the Interest Rates Fall?

Given the relevance of the interest rates over the IRR values, it is important to explore the marginal effects of that variable in the viability analysis of UL – especially if we consider the current falling trend for observed returns. Figure 3 shows a sensitivity comparison of the IRR of UL with the returns earned in the private market (supposing the same investment portfolio as the insurer), based on variations in the remuneration of federal government bonds and considering the other premises of the baseline scenario.

As addressed in section 5.2, if the fixed income returns reproduce or exceed the expected levels, the

interest credited in the individual accounts reduce the expenditures with the insurance portion and with the administration fees associated with it, making the UL more attractive in relation to the private market – especially for policyholder profiles that have a high associated premium. Moving to the left of the graph, however, this effect becomes increasingly smaller: in the extreme case of exceptionally low rates of return, it is not possible to earn any type of return that provides the deduction of the insurance and operational portions of the contract, making the hybrid advantage of the product negligible – if not inexistent. In this case, the UL mechanism comes increasingly closer to the dynamic used in the private market (buying insurance and investing the surplus), but with the intermediation of a company, which in this case needs to be remunerated. As a result of the incidence of the administration fees and the spread retained by the insurer, the individual results of the UL are, in this case, lower than those presented by the private market.

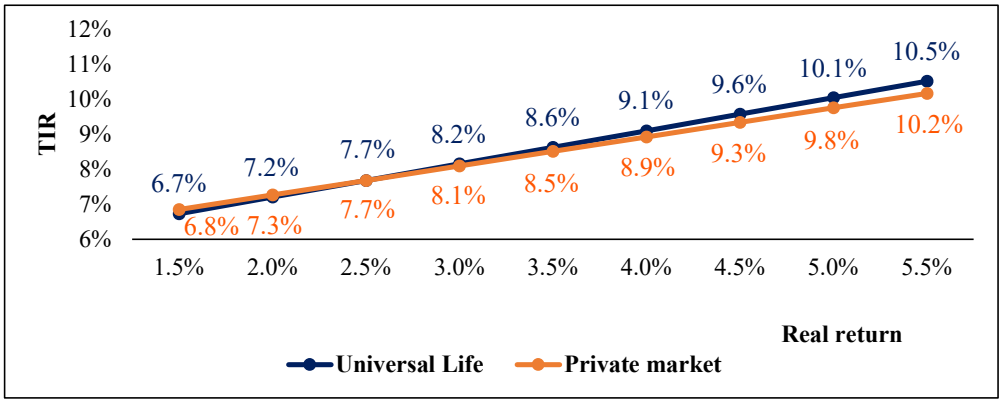

Figure 3 *Marginal effects of the interest rate on the internal rate of return (IRR) and comparison with the private market*
Source: *Elaborated by the authors.*

6. CONCLUDING REMARKS

The main objective of this study was to evaluate – from an individual viewpoint – the viability of UL in Brazil. We ran simulations varying the policyholder's characteristics and the country's macroeconomic scenario, in order to identify both the sensitivity of these variables in relation to the financial result of the product (IRR) as well as the most likely profiles to take it out. Subsequently, we used company assessment metrics to verify the possibility of offering UL and, thus, analyze the effects of creating a national market for the product, given the lack of definition by Susep regarding its regulation.

The results revealed that, considering the baseline scenario, the nominal IRR of 9.1% p.a. is higher compared to the return derived from the separate acquisition of the same benefits offered by the UL in the private market. This is generally observed in the cases of a rise in financial returns obtained and derives from two exclusive characteristics of the product: (i) its hybrid aspect, which enables the use of accumulated returns as a discount factor in the insurance portion and in the fees that would be paid in the private market; and (ii) the possibility of maintaining the same insured cover through the payment of level premium values (contributive flexibility). Both effects are shown to be relevant when the opportunity cost of UL is low in relation to the market acquisition costs, especially in the case in which the individuals are at more advanced ages when taking out the policy (60 years old). Despite not corroborating with the conclusions obtained by Cherin and Hutchins (1987), however, these conclusions are justified by the interest rates in Brazil being historically higher than the US ones.

From the insurer's viewpoint, the most sensitive variable in the results of the profit testing is the contract duration: given the retained spread on the investments and the incidence of high initial transaction costs, the longer the policyholder's permanence in the portfolio, the more earnings the insurer obtains. This fact contrasts with the optimal individual IRR point, which is found after an 8-year contract duration – the moment of equilibrium between the financial accumulation and the rising cost of the protection portion.

Therefore, given the IRR and profit testing results presented, there are arguments that justify the sale of UL in Brazil, especially considering the public that is

older when taking it out, the high national interest rate scenarios, and the policies stimulating long-term insurance policies.

Given the inexistence of a national body of literature on the theme and the non-conclusion of the regulation of the product by Susep, little evidence was found that could adequately portray the tax questions involved in the individual financial planning decision. Similarly, we also did not contemplate the commercial premiums practiced in the market, with these being the main limitations of this study. Besides these aspects, future research could also incorporate the existence of minimum guaranteed rates and the possibility of individual choice of the investment portfolio (variable UL).

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