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Use of artificial intelligence and the collapse of the Brazilian pension system

Use of artificial intelligence and the Brazilian pension system collapse

João Gondim Neto – Pontiff Catholic University of Goiás

ABSTRACT:

We are facing an unprecedented transformation in our society due to the widespread use of Artificial Intelligence, replacing intellectual professions formerly performed by humans. The impact of this large-scale replacement could hasten the collapse of the already fragile Brazilian pension system, especially due to the decline in middle-class income levels and, consequently, their savings. This paper aims, through a comprehensive literature review, to investigate the impacts on pensions in Brazil resulting from the widespread use of Artificial Intelligence.

Keywords: Artificial Intelligence, Social Security, Middle Class, Savings and Retirement.

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are facing an unprecedented transformation in our society due to the widespread use of Artificial Intelligence, replacing intellectual professions that were once performed by humans. The impact of this large-scale substitution may foreshadow the collapse of Brazil's already fragile pension system, especially due to the decrease in middle-class income levels and, consequently, their savings rates.

This paper aims, through an extensive literature review, to investigate the pension-related impacts in Brazil resulting from the widespread use of Artificial Intelligence.

Keywords: Artificial Intelligence, Pension System, Middle Class, Savings, and Retirement.

1. INTRODUCTION

The advent and use of technology undoubtedly differentiates human beings from all others.
species; to such an extent that structuring techniques such as mastery over fire, manipulation of
minerals such as stone, iron, bronze, through the advent of steam engines, computers,
and, recently, generative artificial intelligence, are given as milestones in understanding
social, economic and evolutionary characteristics of the human being itself. With robust security it is
it is possible to say that man creates technique and technique recreates man, molding him according to the
designs of their instincts now equipped with new tools, therefore, it can be assumed that the
technique is not just a means; it is a way of revealing the truth (HEIDEGGER, 1954).

In effect, we are facing one of the most absolute milestones in productive capacity.
human. Through the horizontalization of artificial intelligence tools, humidity finds itself facing
of what is already considered the beginning of the Fifth Industrial Revolution, where robots and human beings
are integrated into an inseparable productive symbiosis. (ZIATDINOV et al., 2024), however with
fatal externalities never before experienced.

If before the advent and massive use of artificial intelligence, especially generative intelligence, the technique
was used as a substitute for manual labor and, in effect, **a catalyst** for capacity

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intellectual of the human being, now AI appears as a definitive intermediary between capital and production[1]. Man, until the beginning of the 21st century, was encouraged to study and develop his cognition, while worker valued for his creative and analytical skills, now finds himself faced with the possibility concrete possibility of having your "brain replaced", definitively, by semi-conductors and colossal clouds of data; this replacement occurs not only due to the absurd analytical capacity of AIs, but also by the ever-decreasing costs of processing, synthesizing and obtaining knowledge, promising not only productivity gains on an unprecedented scale, but also a structural transformation - and structuring - of the economy, work and society.

The fear of jobs being replaced by machines is nothing new. As points out Ricardo (1821) in *Principles of Politics and Taxation,* it is clear that the introduction of machines would be able, in the short term, to reduce the demand for labor. In light of the Great Depression, Keynes (1933) emphasizes the unequivocal relationship between technology and job elimination. However, current technological innovations, having as a mechanism the evolution of generative AIs, emphasizes the fears highlighted by Brynjolfsson and McAffe (2014) according to which the accelerated pace of technology has increased the spectrum of human activities that are likely to be replaced by machines.

> (…) the authors draw attention to the fact that new technologies are being adopted faster than ever before. Therefore, recent and renewed fear of mass job destruction due to automation, seems to be more reasonable than in the past. (BRYNJOLFSSON; McAFFE, 2014, *apud* Ottoni et al., 2022).

Several professionals who work using their intellectual capacity are already being replaced by AIs. The detailed study carried out by Microsoft (2025) indicates that professionals as writers and authors, translators, scientists and political analysts, journalists, mathematicians, and by incredible as it may seem, junior programmers are on the list of activities with the highest risks and replacement by Artificial Intelligence. This fact is unprecedented in humanity, which until now had assisted machines taking over human manual labor, and not the creative capacity and highly complex cognitive process. In turn, renowned probabilistic studies that use methods quantitative studies to assess the impact of AI on job elimination indicate that in United States 47% of the jobs currently performed by humans will become extinct within a timeframe of up to 20 years (FREY; OSBORNE, 2017). In Brazil it is no different, on the contrary, the replacement of positions of work through advanced AI-based technologies, tends to be even more pronounced in developing countries than in developed countries (OTONNI et al., 2022). Studies indicate

[1] https://www.cnnbrasil.com.br/economia/negocios/inteligencia-artificial-esta-substituindo-humanos-mais-rapido-do-que-voce-pensa-show-search/?utm_source=chatgpt.com

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that, in Brazil, 55% of formal jobs have a high risk of disappearing or being replaced by the use of generative AIs in the next two decades (ALBUQUERQUE et al., 2019). In turn, the risk of substitution in the informal sector is even greater. Applying methodology similar to that used by Frey and Osborne (2017), in the most critical scenarios, there is a high probability that 62% of informal jobs will be replaced by the use of intelligence artificial in the next two decades (OTONNI et al. 2022).

Undoubtedly, the odds point to a mass replacement of labor intellectual human by AIs, and although it is too early to have a complete view of the social impacts and economic aspects of these structural changes in Brazil, it is possible to state that the replacement of positions of work by AIs will substantially impact the income level of the middle class, as will Previous Industrial Revolutions that profoundly impacted the income and employment levels of low-skilled workers, especially in the short term (KEYNES, 1933); since the Brazilian middle class, with emphasis on generation *Y,* qualified to develop precisely the intellectual activities that are now being replaced by AIs, as pointed out by Tomlison et al. (2025) in research conducted by Microsoft.

In fact, also taking into account a) the high correlation between income level and savings according to with Silveira and Moreira (2015) in the IPEA report that evaluates the variables determining savings of Brazilian families and b) the low levels of savings in Brazil compared to other countries in development, as indicated by the survey carried out by the IMF (2022), we are facing, if not the possibility of the fatal collapse of the current social security model, of the critical acceleration of this collapse, in addition to the numerous articles and discussions that have taken into consideration the changes in age-demographic characteristics of the Brazilian population, according to which, the aging of the population associated with a progressive reduction in the birth rate, would be the main responsible by the implosion of the Brazilian social security system.

Therefore, this work has the sincere intention, through recent studies and analysis bibliographical, present the points that corroborate the fact that we are facing the implosion of Brazilian Social Security System that may occur much sooner than expected, due to the drastic reduction in middle-class income levels, and therefore savings levels, caused by changing the dynamics of jobs through the horizontalization of the use of intelligence artificial.

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2 THEORETICAL FRAMEWORK

2.1 The Theory of Cycles

Conceptually, we can understand savings as being the fraction of disposable income that families voluntarily allocate to the purchase of financial and real assets across a wide range of reasons (SILVEIRA and MOREIRA, 2015). Since it is the surplus income after consumption, the theoretical models that analyze savings rates arise from the models used to explain consumption, as proposed by Friedman (1957), through the Permanent Income Model and Modigliani and Brumberg (1954) with the widely known Life Cycle Model, which explains individuals' lifetime savings rates as a function of their preference between present and future consumption.

> (…) based on expectations about future income and prices, a family chooses a consumption plan that maximizes its intertemporal well-being subject to the budget constraint that the present value of its expenditures is limited by its permanent income, which in turn is determined by the sum of current wealth and the present value of the expected flow of future income. (SILVEIRA and MOREIRA, 2015, p. 11)

Thus, following the proposal by Modigliani and Brumberg (1954), the volume of savings of individuals depends on their lifetime income expectations and not just their current income, that is, the individual or family's stage of life in the life cycle determines the level of consumption, and therefore consequently, the savings rate. (COSTA and MIRANDA, 2013). In other words, it can be stated, in light of the model proposed by Modigliani and Brumberg, that during youth people have negative savings (incurrence of debt). By middle age, these individuals reach the peak of their income when they then pay off the debts they have incurred and start saving for the retirement phase. retirement, where again there is the use of financial stock to meet the needs of consumption. Figuratively, income generation over a lifetime can be understood as a “U” inverted, and although some empirical evidence demonstrates a certain parallelism between consumption and income, which would denote a fixed savings rate, the literature brings the concept of smoothing consumption, according to which consumption does not necessarily follow the income trajectory current over the life cycle, resulting in varying lifetime savings rates; a unfolding of Freidman's model (1957) where families make their consumption decisions, and by consequent savings, based not on current income that incorporates permanent and eventual income fluctuations, but rather, only in permanent income.

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In line with this concept, it is also possible to state, according to Mankiw (2018), that a high income results in a low average propensity to consume, and therefore, in a greater propensity to savings, which can be attested by empirical evidence. Hugget and Ventura (2000) demonstrated through research that the lower the income level of American families, the greater the tendency of these families to have negative savings, while middle-aged individuals tend to have the highest levels of income and, consequently, savings, corroborating the models by Modigliani and Brumberg (1954).

> The data shows that people with higher incomes tend to save more for retirement and have a higher savings rate compared to people low-income individuals throughout life. As individuals with higher education levels tend to have higher incomes, as shown by Van Rooij, Lusardi and Alessi (2011), Campbell (2006), Bernheim et al. (1997), by Schultz (1961), Mincer (1974) and Becker (1962) the tendency would be for individuals with higher education save more. (COSTA and MIRANDA, 2013, p. 4)

Substantial data collected through Household Budget Surveys conducted in years 2002-2003 and 2008-2009 in Brazilian households, show the same conclusions, as can be seen in the following table, where: S1 is the net value of the purchase of purely assets financial; S2 is the value S1 plus the net purchase of real estate; S3 is the value S2 plus the net purchase of vehicles; S4 is S3 plus the net purchase of other durable goods and finally, S5 is S4 plus human capital expenditures (education and health). Regarding the classes of education the table subdivides into 5 distinct bands according to the years of study: primary incomplete (<4), incomplete secondary (>=4, <8), incomplete high school (>=8, <11), higher education incomplete (>=11, <15) and complete higher education (>= 15).

The following table makes it clear that, in Brazil, the propensity to save increases as the income level grows; not only that. The POF data show that the ratio between the average savings and average income also grows as the level of education increases, proving empirically proposed by the aforementioned authors.

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Table 1 - Savings Statistics by Different Sample Segments

	Classes de escolaridade: anos de estudo					Coorte: ano de nascimento do chefe					POF		
	<4	[4,8)	[8,11)	[11,15)	>15	<50	[50,60)	[60,70)	[70,80)	>80	2002	2008	**Total**
						Poupança média							
S1	5	16	20	54	360	46	60	37	31	16	16	63	**41**
S2	32	64	85	162	658	90	142	121	110	72	56	157	**111**
S3	71	139	182	329	1056	167	269	235	213	157	125	288	**212**
S4	118	204	264	441	1275	230	352	320	299	250	187	383	**292**
S5	191	306	393	668	1847	402	541	468	400	327	310	552	**440**
Renda	884	1.243	1.513	2.178	4.732	1.473	1.843	1.648	1.364	1.152	1.278	1.769	**1.541**
						Taxa de poupança média							
S1	0,02	0,05	0,02	0,02	0,44	0,02	0,21	0,01	0,01	0,02	0,01	0,09	**0,05**
S2	0,04	0,08	0,06	0,04	0,51	0,03	0,26	0,04	0,04	0,07	0,04	0,12	**0,08**
S3	0,07	0,12	0,10	0,08	0,51	0,06	0,27	0,07	0,08	0,12	0,06	0,16	**0,11**
S4	0,09	0,14	0,12	0,10	0,51	0,08	0,29	0,10	0,12	0,16	0,09	0,18	**0,14**
S5	0,17	0,21	0,20	0,19	0,59	0,18	0,35	0,17	0,18	0,21	0,17	0,26	**0,21**
						Razão entre a média da poupança e a média da renda							
S1	0,01	0,01	0,01	0,02	0,08	0,03	0,03	0,02	0,02	0,01	0,01	0,04	**0,03**
S2	0,04	0,05	0,06	0,07	0,14	0,06	0,08	0,07	0,08	0,06	0,04	0,09	**0,07**
S3	0,08	0,11	0,12	0,15	0,22	0,11	0,15	0,14	0,16	0,14	0,10	0,16	**0,14**
S4	0,13	0,16	0,17	0,20	0,27	0,16	0,19	0,19	0,22	0,22	0,15	0,22	**0,19**
S5	0,22	0,25	0,26	0,31	0,39	0,27	0,29	0,28	0,29	0,28	0,24	0,31	**0,29**

Fonte: POF 2002-2003 e POF 2008-2009.

2.2 The Brazilian Social Security Model

Initiatives aimed at promoting some form of social security protection date back to the end of the 19th century with few corporatist initiatives and without universal coverage to support workers of some state-owned companies. But it was in 1923 with the Eloy Chaves Law through Decree Legislative nº 4.682, of 01/24/1923, which established the guidelines as well as the CAPs (Caixa of Retirement and Pensions) for railway workers. Years later, with the enactment of the 1946 Constitution, at the beginning of the government of Eurico Gaspar Dutra, an even bigger step was taken given in the structuring of a national social security project based on the tripartite contribution between union, employer and employee. This project defined the basis for retirement based on length of service service, disability benefits, work-related accidents, death and maternity benefits. In 1988, with the promulgation of the current Federal Constitution, the concept of Social Security was established, encompassing in this, not only Social Security, but also Social Assistance and Health (GOES, 2020). In effect, this new scope of the concept was based on the tripod of **universality of coverage, intergenerational solidarity and the contributory and compulsory nature of the social security,** giving rise to the General Social Security Regime administered by the INSS.

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It wasn't long before the social security model described by the 1988 Constitution presented its first weaknesses. Exactly 10 years after the promulgation of the Charter Magna, whose spirit was to guarantee Brazilians an endless range of rights and guarantees despite of their costs, the first reforms were carried out through EC nº20/1998, which aimed to correct the financial imbalance resulting from the low level of savings and the aging of the population population. A minimum retirement age and stricter rules for retirement based on length of service. In the Lula I, Lula II and Bolsonaro governments, they were also constitutional reforms were made to restrict retirement rules, such as: the abolition of retirement based on contribution time without minimum age, new calculation rules, restriction on accumulation of benefits, institution of contributions from inactive and pensioners, creation of possibilities supplementary pension through closed pension funds and the creation of Funpresp (Federal Public Servants' Supplementary Pension Fund) to guarantee the supplement of income, since the new employees would have the benefit limited to the RGPS ceiling. And, despite the constant intensification and limitations of Brazilian social security rules, still raise hundreds of discussions and articles debating the sustainability of the model (REIS and CASAGRANDA, 2023).

There are 3 social security models provided for in the 1988 Federal Constitution: The aforementioned 1) General Social Security Regime (RGPS) which deals with the rules for retirement of private sector workers, self-employed workers and MEIs, where there is solidarity financing through simple distribution (active people finance the retirement of inactive people); 2) the RPPS, or Own Regime of Social Security, aimed at federal, state and municipal public servants, where each Entity of the federation may have its own social security system, as long as it follows constitutional norms described in Article 40 of the Federal Constitution, and which, despite having financing through a distribution, has particular rules regarding age and time and contribution, as well as the calculation of benefits; and the 3) RPC, Supplementary Pension Scheme, established by Complementary Law No. 109/2001, which works like a private pension savings account where capitalization is individual, that is, each person accumulates his own reserve in open funds (managed by banks and insurance companies in form of PGBLs and VGBLs) or closed (pension funds linked to companies or categories).

2.3 Criticism of the Current Brazilian Pension System

Current Brazilian demographic trends are not encouraging considering the RGPS. Since our pension structure is based on the model where active workers contribute to the payment of benefits to retirees, the central pillars for the sustainability of this model are 1) the maintaining the largest number of people of working age, as well as economically active (employed or seeking employment), through high birth rates, compared to 2) lower

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possible number of benefit users, caused by higher mortality rates. Exactly for this reason, the aging of the population caused by a progressive reduction in rates birth and mortality (LEE, 2003), is one of the main reasons for recurring changes in social security rules, which aim to change the set of norms and conditions in order to maintain foot the structure, compromised since its genesis.

What makes this conclusion more alarming is that Brazil still has a young population compared to other European countries that have gone through this transition demographic, is the fact that we are in an accelerated process of transition; a transition that in other demographically more mature countries took more than a century to happen, in Brazil, it is estimated that it will occur by 2040. (TAFNER, BOTELHO and ERBISTI, 2014, apud Silva et al., 2022).

In an attempt to correct the structural deficits of the Brazilian social security system, several studies seek to find ways to mitigate the pension deficit. Silva et al. (2022) in one of the proposed simulations, aiming to maintain the deficit at -1.3% of the Gross Domestic Product - GDP, states:

> The results show that introducing a minimum age of 60 or 65 years for women or men is insufficient to stabilize the pension deficit in the medium term term, making it necessary to combine this measure with a reduction in the values of benefits. Among the reform scenarios evaluated, the combination of these two measures generate the lowest cost to society. On the other hand, the reform that generates the biggest cost to society is the increase in the contribution rate social security. (SILVA et al., 2022, p. 89)

Still according to the results obtained in the studies by Silva et al. (2022), to maintain the social security deficit is stable at around -1.3%, it would be necessary to either increase the rates average social security contributions of 19%, 24.4%, 35.7% or 53.5% in 2018, 2020, 2025 and 2030 respectively, or a reduction in average benefit values of -22.5%, -27%, -36.6% or -44%, respectively in the same years.

Given the magnitude of these numbers, it is plausible to assume that an isolated measure would not be sufficient to contain the growth of the social security deficit, eventually requiring both reduction in the value of benefits, as well as a concomitant increase in the contribution rate. Furthermore, since the entire structure that supports the Brazilian social security system is based on in the solidarity financing model through simple distribution, more important than dealing with the aging of the working- *age* population , is to treat and analyze the behavior of the population *economically* active, that is, individuals employed or seeking employment (SILVA et al., 2022); since, due to the tripartite contribution model, both the portion borne by the agents public and private, as well as that paid by workers to the INSS, depends mainly on

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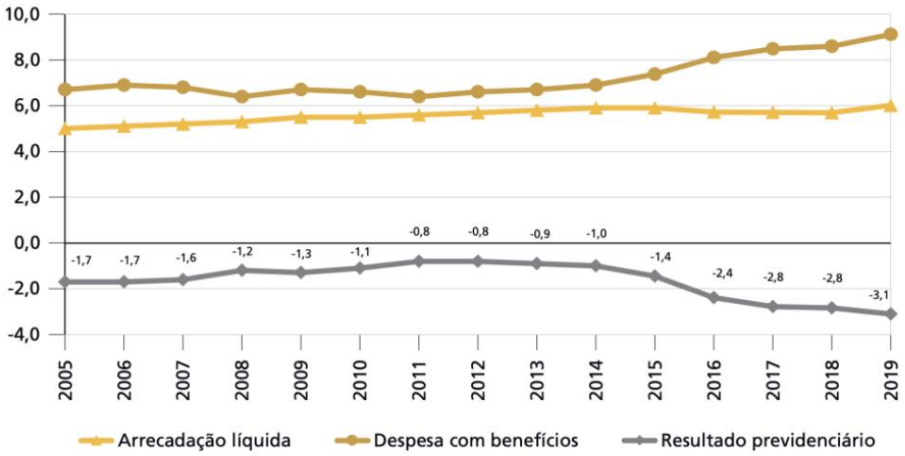
of the population that is actually employed, and which to a large extent distinguishes itself from the portion of the population benefiting from welfare aid such as Bolsa Família.

Going by the numbers, it is possible to understand that, in fact, social security in Brazil, despite the numerous reforms already carried out, it has fatal flaws in its foundation. According to the Court Federal Audit Office - TCU, in 2019, only the RGPS corresponded to an expense to the coffers public funds of R$626.5 billion, of the R$767.8 billion allocated to public pension schemes, representing 43% of all primary expenses (TCU, 2019). In effect, the net result between collection and social security expenditures, remains not only in deficit, but increasing, as can be seen in the graph below taken from the study by Silva, Porsse and Bittencourt (2022).

Chart 1 - RGPS Social Security Result in Relation to GDP (2005 - 2019) - %



Fonte: Resultados do Regime Geral de Previdência Social/Ministério do Trabalho e Previdência Social – 2019. Disponível em: <https://bit.ly/3Eh2hB9>. Acesso em: 30 jan. 2020.
Elaboração dos autores.

According to Tafner et al (2014), given the GDP growth rate of around 2.9% per year, the current 7.2% of GDP spent on social security would jump to 10.34% in 2050. In the same way mode, through projections made through advanced mathematical models, the study of Silva, Porsse and Bittencourt (2022) predict that in 2040 expenditure on RGPS benefits will reach the level of 12.4% of GDP, while net revenue would be in the order of 6.4% of GDP, a deficit of -6%, five times greater than that presented in 2010.

This data denotes the structural fragility of the social security model adopted in Brazil, which has at its core the intrinsic dependence on high birth and death rates. Having in view of scientific developments in the areas of health and longevity around the globe, with a reasonable improved access to disease prevention and treatment, associated with rising parental costs, what we see in Brazil is the exact opposite: a reduction in birth and death rates. This

forecast demonstrates the imperative need not only for studies, but for effective actions (and often politically unpopular) towards a structural reform of the Brazilian social security model.

In fact, beyond this complex and challenging problem, we are faced with a new agent that, even faster in terms of its power of transformation, promises to significantly compromise the income levels of the economically active population, especially the Brazilian middle class.

2.4 IBGE Income Definitions

In order to continue with the investigation, in order to clearly define the objective, we need to discuss who constitutes the aforementioned Brazilian “middle class”; and to do so, some considerations regarding the criteria of 1) income classification, 2) semantics and in particular, since that the proposal of this article is the likely worsening and acceleration of the pension collapse Brazilian due to the reduction of jobs, 3) identification of jobs usually occupied by the 'middle class'.

2.4.1 Classification by Income Range

Interestingly, the IBGE, the number one reference in demographic research in Brazil, does not uses this classification, that is, there is no official standard methodological definition that circumscribes an economic group by the term 'middle class'. However, other official sources adopt the term to refer to certain income brackets.

The Secretariat for Strategic Affairs of the Presidency - SAE/PR (2012), through the National Household Sample Survey - PNAD/IBGE defined middle class as families that have per capita income between R$291 and R$1,109/month. Bringing these values to present value, assuming as correction factor the IPCA calculated from 2012 to the present date (04/2025), it is possible define as 'middle class' families whose per capita income varies between R$626 and R$2,193. Using this criterion, according to a publication by Empresa Brasil de Comunicação - EBC (2014), the official body of government, this group represents 54% of the Brazilian population.

Another common classification according to the Brazilian Association of Population Studies - ABEP is the segmentation into classes represented by the letters A, B, C, D and E, with class “C” being considered the Brazilian middle class. According to the methodological definition of the Getúlio Vargas Foundation - FGV by through Neri's report (2011), analyzing precisely the classification *per se* of the middle class Brazilian, the household income ranges between R$1,064 and R$4,591 were adopted as the definition conceptual of 'middle-class family'. Bringing these values to present value using the IPCA as a correction index, respectively, we have the range that goes from R$ 2,853 to R$ 12,309. If considering the average number of people per household in Brazil of 2.79 (PNAD/IBGE, 2022),

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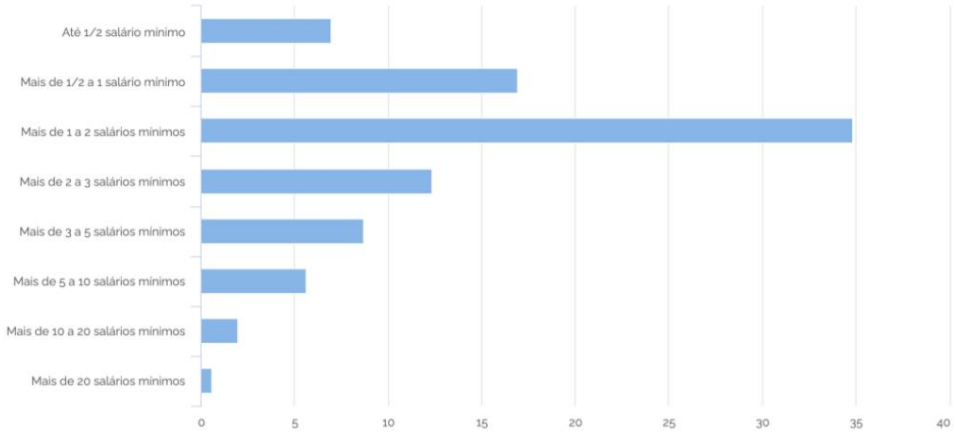
we can assume that according to the FGV classification the per capita/household income range is from R$ 1,022 to R$ 4,411, approximately double the value adopted by SAE/PR (2012).

In turn, the World Bank (2018) defines middle class as families that have an income per capita between US$13 and US$70/day. Assuming the current dollar exchange rate of R$5.52 and correcting values by IPCA, according to the definition of the World Bank, is understood as 'middle class' in Brazil families that have a household income between R$2,152 and R$11,592; in turn, this value is similar to that considered by FGV.

Although the IBGE does not adopt the term 'middle class', the following graph can give some direction to coherently define the term 'middle class' to which we refer in this article. According to IBGE (2015), approximately 34.85% of people earn between 1 and 2 salaries minimum wages, while 12.36% of Brazilians are in the range of 2 to 3 minimum wages, totaling 47.2% of the economically active population.

Chart 2 - People aged 15 and over by Income Class
Monthly, 2015



Source: IBGE/PNAD (2015) https://www.ibge.gov.br/estatisticas/sociais/educacao/9127-pesquisa-nacional-por-amostra-de-domicilios.html?t=destaques

Given the minimum wage value of R$ 1,518.00, adopting the average per capita income as the value of 1 up to 3 minimum wages, and the average number of people per household in the order of 2.79 (PNAD/IBGE, 2022), it is possible to infer that the average household income would be respectively R$ 4,235 to R$ 12,706.

2.4.2 Semantic Classification

If there is no objective quantitative criterion regarding the income range that determines, or fits, the individual in the definition of 'middle class', nor is there a single subjective definition. Between the decades In the 60s and 70s, the term 'middle class' was used to politically describe a segment of the

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population neither proletarian nor belonging to the upper classes of the bourgeoisie (ALBUQUERQUE, 1977). In the first decade of the 21st century, other authors sought to classify the so-called 'middle class' according to their consumption preferences, in such a way that individuals who are members of the so-called 'middle class' would be those with enough income to consume beyond the basics, but without accumulating wealth enough to be considered upper class (NERI, 2011), or even as being part of the population that has a stable consumption pattern, access to private services (school, health, transportation) and some degree of savings and credit (BARNERJEE and DUFLO, 2007)

Some authors brought a concept linked to sociological issues in studies of class. For Scalon (2011) the middle class should not be seen only as an income bracket, but as a set of intermediate social positions between the elites and the working classes. For her, **professionals with relative autonomy at work such as freelance professionals, civil servants public and specialized technicians, most of whom had some higher education,** would be defined as members of the middle class. Another author describes the middle class as being a **expansion of the working class with greater consumption capacity** (SALATA, 2016), for the author, this group would have high cultural capital either in terms of education or technical training professional, and emphasizes that there is a mistake in using only income bands, such as SAE and FGV, because this would overestimate the real size of the middle class in Brazil.

In a way, the idea that this would overestimate the size of the 'middle class in Brazil' is corroborated by the minimum amount of remuneration necessary to guarantee a quality of life decent in Brazil, which according to DIEESE (2025) is R$ 7,528.56. Adopting this value as minimum consumption reference in order to guarantee reasonable access to education, health, food, leisure, etc., when observing Graph 2 it is possible to notice that only about 8% of the population has an income higher than the level suggested by DIEESE (2025); if we disregard the last two ranges, assuming that this would be the top of the pyramid containing approximately 3% of the population, it follows that the middle class in Brazil corresponds to only 5% of the population.

Another author, Quadros (2003), subdivides the middle class according to its typical occupation. The first subdivision would be the self-employed professionals who carry out activities related to commerce, office, provision of services, or in general, activities carried out in a independent as salespeople, supervisors, sales representatives, etc. In turn, the other part according to Quadros (2003), would be the professionals who perform activities in a salaried as administrative assistants, receptionists, teachers, among others.

It is possible to state with a high degree of certainty that something in common is found in conceptualization of the term 'middle class' for the last three authors: use of intellectual labor force; that is, people who, through improving their technique through study and/or practice, make use of

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cognitive capacity to perform work activities whose driving force is the use of their mental faculties.

2.4.3 Professions Most at Risk of Being Replaced by AIs

The accelerated pace at which Artificial Intelligence and robotics enter production chains has alarmingly reducing the number of jobs in some occupations. The massive use of these automation technologies have been causing growing fears of large-scale unemployment, and from a historical perspective, the disappearance of certain occupations comes with an increase in unemployment (XU, 2022).

According to Xu et al., (2022), occupations with the highest risk of replacement by AIs are those that rely primarily on *information rule-based routines,* that is, tasks whose main objective is to compile, analyze and produce information algorithmically, respecting a sequence of rules and conditions. Therefore, unequivocally, the use of AIs is capable of considerably increasing the productivity of this type of task. Some activities can even benefit on a large scale from the use of AIs in their routines, such as programming, customer support, medical diagnosis, writing, consulting, advertising, entrepreneurship, legal analyses, etc. (TOMLISON et al., 2025)

However, increasingly efficient Artificial Intelligences, with the capacity to increasingly larger processing capacities can go beyond the spectrum of “helping humans increase intrinsic productivity of their activities” to “make the use of humans unnecessary in activities based on information rules”, given the efficiency that computers have in this range of tasks. As can be seen in the table below, the result of the study published by Xu et at. (2022).

TABLE 2 - The 10 Professions at Highest Risk of Being Automated

Occupation	Risk
Archivists	0.7002
Real estate agents	0.6968
Typists and typists	0.6943
Payroll and time tracking assistants	0.6941
Data entry clerks	0.6940
Transportation engineers	0.6938

Credit analysts	0.6938
Insurance adjusters (automobile damage)	0.6938
Insurance underwriters	0.6938
Tax and collection auditors and inspectors	0.6938

SOURCE: XU, Dawei; YANG, Haoran; RIZOUI, Marian-Andrei; XU, Guandong. Being Automated or Not? Risk Identification of Occupations with Graph Neural Networks. Sydney: University of Technology Sydney, 2022.

A simple assessment in Table 2 shows that professions with a high risk of being replaced by AIs are all of an intellectual nature, that is, unlike what happened in especially in the First and Second Industrial Revolutions where machines replaced human beings in intrinsically manual activities with a high degree of repetition. Table 3, the result of the study of Microsoft (2025) corroborates this conclusion. It shows the functions where the use of AIs is capable to meet demands without interference (or minimal interference) from human beings. The “Coverage” defines the scope of demands met by the respective professionals that can be executed by IAs.

TABLE 3 - 40 Professions with high applicability of AIs

Position	**Coverage**
Interpreters and Translators	0.98
Historians	0.91
Flight Attendants	0.8
Service Sales Representatives	0.84
Writers and Authors	0.85
Customer Service Representatives	0.72
CNC Tool Programmers	0.9
Telephone operators	0.8
Travel Agents and Attendants	0.71
Radio Announcers and Presenters	0.74
Brokerage Clerks	0.74
Domestic and Rural Management Educators	0.77
Telemarketing Operators	0.66
Doormen / Concierge	0.7

Political Scientists	0.77
Journalists and News Analysts	0.81
Mathematicians	0.91
Technical Writers	0.83
Proofreaders and Copy Editors	0.91
Hosts and Receptionists	0.6
Editors	0.78
Administration Professors (Higher Education)	0.7
Public Relations Specialists	0.63
Product Demonstrators and Promoters	0.64
Advertising Sales Agents	0.66
New Accounts Clerks	0.72
Statistical Assistants	0.85
Rental and Counter Attendants	0.62
Data Scientists	0.77
Personal Financial Consultants	0.69
Archivists	0.66
Economics Teachers (Higher Education)	0.68
Web Developers	0.73
Management Analysts	0.68
Geographers	0.77
Models	0.64
Market Research Analysts	0.71
Public Telecommunications Specialists	0.66
Switchboard Operators	0.68
Professors of Library Science (Higher Education)	0.65

TOMLINSON, Kiran; JAFFE, Sonia; WANG, Will; COUNTS, Scott; SURI, Siddharth. Working with AI: Measuring the Applicability of Generative AI to Occupations. Microsoft Research, 2025.

3. METHOD

This article is based on the hypothesis that the widespread use of Artificial Intelligence has a great chance of worsening the already critical Brazilian pension problems by reducing the

the income level of the middle class, and consequently, the savings capacity of this group of people population.

In this way, an exploratory and qualitative investigation was carried out, based on bibliographical, documentary and critical research of existing literature, through secondary sources, including academic articles, institutional reports (IBGE, FGV, DIEESE, SAE, OCDE) and studies of national and international researchers, in order to demonstrate the following assumptions:

A. The unequivocal relationship between the intensification of the use of AIs and the reduction of jobs work, and consequently, income level.;
B. The reduction in savings levels due to the reduction in income levels of the class average and its relevant participation in the Brazilian demographic volume;
C. The worsening of Brazilian social security problems due to the reduction in savings capacity in Brazil.

3.1 Definition of the Object of Study

For methodological purposes, in this article, the economically active population will be segmented into three strata: lower class, middle class and upper class. To this end, once the conceptual definition has been established, intermediate extract, it is possible to deduce by analogy the other lower and upper extracts.

Since, through semantic conceptualization, it is possible to define as 'middle class' the portion of the "working population with a greater consumption capacity", we can discard the classification from SAE/PR (2012) which, brought to present value and taking into account the number of 2.79 people per household, suggests that a middle-class family earns between R$1,747 and R$6,118, below the minimum suggested by DIEESE to guarantee a "dignified minimum quality of life", leaving, therefore, the FGV and World Bank classifications. In both, the family income ceiling classified as 'middle class' is close to R$12,000, a value similar to the extrapolation using the value of 2.79 people/household for a person who earns exactly 3 minimum wages: R$ 12,706; therefore, this will be the income range ceiling for the population stratum that, in this article, is defined as 'middle class'.

It remains therefore to define the lower limit, and although both in the FGV proposal and from the World Bank, are between 2 and 3 thousand reais of family income, for this study we will consider being 1 minimum wage per person/household, which again, extrapolated to 'family income' considering the factor of 2.79, it results in R$ 4,235. Thus, the income range considered, in order to classify 'a middle-class family', it will be between R$4,235 and R$12,706, therefore families composed by people who earn between 1 and 3 minimum wages per month, therefore 47.21% of the population economically active Brazilian.

3.2 Considerations Regarding the Defined Scope.

According to the classification adopted in this study, although the population range below middle class (individual remuneration <= 1 minimum wage) is representative in terms of number of individuals, after all, it is 24% of the economically active Brazilian population, the capacity to savings in this segment are fatally compromised, and even if we consider the compulsory factor of the actuarial contribution, it is assumed that this entire layer does not contribute, since they earn less of a minimum wage per month, and, given that the minimum remuneration for the formal work regime is a minimum wage, it is assumed that these people, in their vast majority, are in the informal sector. Therefore, even though the 'lower class' extract is representative in population terms, in terms of savings capacity and contribution to retirement the same cannot be said, so therefore, it is possible to infer that economic changes that impact the income level of this layer of the population will have a smaller impact on the social security system in terms of the volume of capital available for payment of benefits.

Furthermore, since the object of this study is the hypothesis that the massive use of AIs would impact in the employment and income level of a significant portion of the population, the lower class stratum does not would be as impacted as the others, since, for the most part, salaries lower than a minimum wages are not given to roles that require professional qualifications of an intellectual nature; these professions, which studies suggest are at risk given the widespread use of AIs.

At the other end of the spectrum we have the highest income stratum composed of individuals who earn more than R$4,554 (family income greater than R$12,706), and given the extremely wide since the last range with a salary ceiling limitation, according to the IBGE ranking (2015), is up to R$ 30,360 of individual income, a brief digression is in order here. For the sake of precision of the scope studied, we will segment the previously referred to 'upper class' into two segments: 'class 'upper middle' and 'upper class'.

Considering the upper class as the population spectrum that is among the 3% with highest remuneration in Brazil, we can infer that, although for this spectrum the propensity to savings is superior to the other classes, two things can be assumed: 1) the upper class, given the nature of their activities that are more linked to leadership positions in large companies, the high civil servants and businesspeople, have a low risk of imminent replacement of their jobs through AIs, since it does not appear in any of the mathematical simulations in the bibliographies that this study used as a theoretical framework; in addition, 2) given the nature of the investments carried out by the upper class and the RGPS ceiling, it is perfectly feasible to infer that the class high, to a large extent, does not depend on public social security benefits, and therefore,

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would be very little impacted by problems related to the lack of public resources for payment of the benefit.

In turn, the upper middle class, representing 14.3% of the economically active Brazilian population active (IBGE, 2015), is not only voluminous enough to become representative in terms population, fits into the stratum of individuals with an admissible propensity to save, but also, it tends to be a layer composed of people who are not paid for work manual labor, but rather of an intellectual nature, therefore, it could be encompassed by the object of this study, here defined as 'middle class'. However, for three reasons we will leave the 'upper middle class' out of this study: 1) given the heterogeneous nature that brings it closer to the 'upper class' which clearly, for the reasons mentioned above, are not part of this analysis, 2) because this population group mainly resorts to to other forms of retirement financing, in addition to the RGPS and 3) authorial definition of scope to be studied. From now on, however, it is possible to assume the need, that in opportunities future studies address the income and social security impacts of the widespread use of AIs in this segment, given their relevance in terms of population.

4. RESULTS AND CONCLUSIONS

As demonstrated in topic 2.3, Brazil faces serious sustainability challenges. of its pension model. Therefore, several reforms were made in an attempt to address the impact of the practically inevitable aging of the population, caused by the reduction of birth rates as well as mortality rates. Although this is real and critical to the model compulsory contribution by simple distribution (where the amount paid by economically disadvantaged young people assets is not used to establish their retirement, but to guarantee the payment of benefits to the inactive), there is a factor that can aggravate and anticipate the collapse of Brazilian social security: the significant reduction in the amount collected by the INSS caused by unemployment and reduction in salary levels of a significant part of the population *economically* active, and not only of the working- *age* population as most of the population do today. analyses are based on.

Since savings capacity increases as income and education levels increase, increases, as was attested in chapter 2.1, and obviously, the construction of assets for retirement has a direct correlation with income and savings capacity, which fluctuates throughout life life, as demonstrated in the Life Cycle models (MODIGLIANI and BRUMBERG, 1954) and Permanent Income (FRIEDMAN, 1957), it is plausible to assume that a) the greater the number of individuals in a given economically active population stratum, and b) the higher the level of income and education of this segment, the greater their propensity and capacity to build wealth

for retirement. Therefore, it is perfectly plausible to infer that the spectrum that best suits fits this description is the object of this study, that is, the 'middle class'.

The middle class, not only in population terms, is extremely representative, since represents 54% of the Brazilian EAP, but also in terms of its investment capacity, which, although small compared to the higher extracts, it is undoubtedly larger than the base of the pyramid. For this reason, possible structural impacts on the capacity to generate income and middle class savings, could significantly compromise financing conditions of the current Brazilian social security model.

When considering the recent studies by Tomlison et al., (2025) and Xu et al., (2022) that analyze the potential for some occupations to be replaced by AIs and the ranking of these occupations is done, it is It is easy to see that most of them are of an intellectual cognitive nature and performed by professionals with a reasonable level of education, especially with higher education; in Brazil, a portion of the population that is notably associated with the so-called 'middle class' enclosed in the spectrum defined as object of this study. This intersection between the group composed of the Brazilian 'middle class' and the professions with high potential to be replaced by AIs, with subsequent unemployment and consequent loss of income, demonstrates the critical scenario that can be established in the country regarding the ability to maintain the purchasing power of a significant portion of the population Brazilian people who, in theory, enjoy or will enjoy social security benefits in their retirement. And, the most alarming thing is undoubtedly the speed at which this can happen.

Although the studies evaluated in this article point to a collapse of the current regime social security in Brazil due to population aging in 2050, this collapse could be anticipated if the predictions of studies evaluating the extinction of certain professions come true as a result of the use of AIs, pointing out that this could occur in up to a decade, which is without a doubt of doubts would put the lives of tens of millions of retirees in the country at risk. The most optimists emphasize a possible reduction in price levels resulting from the increase in productivity which, in theory, would mitigate the impacts, but if this is accompanied by a an even more drastic reduction in income levels and, consequently, in the demand for goods and services, we are facing a calamitous scenario, very similar to what was seen during the historic crisis of 1929, where the absurd increases in production resulting from technical developments grew unaccompanied by the purchasing power of families.

The inevitability of this process, given the incredible productivity gains achieved with the use of artificial intelligence makes this whole scenario not a question of “if”, but of “when”. All socioeconomic dynamics will be altered, but not only that, the very conception of man as an inseparable part of the transformation in the world, it seems to show signs that it will be placed at the proof.

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