The collapse of Brazilian Social Security: Macroeconomic impacts of the increase of the minimum age of PEC Nº 287/2016 reform

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Abstract
This paper presents a simulation of the economic impacts of the increase of the minimum age contained in the Proposal for Constitutional Amendment (PEC) Nº 287/2016. For that, an overlapping generations (OLG) model with 57 generations was built, including the transition rule. The results suggest that not increasing the minimum age for retirement is a very bad choice for society. The fiscal situation becomes unsustainable, and the expansion of social security expenditures, in combination with the reduction of the labor supply, leads the country to a scenario of a sharp fall in consumption and output per capita. The simulation with the new minimum retirement age of PEC Nº 287/2016 indicates that, although it is not the definitive solution to the Brazilian pension issue. The results of the model indicate that raising the minimum age avoids a very bad scenario, but does not seem to be even able to maintain the current level of output per capita. As a policy suggestion, although PEC Nº 287/2016 has not even been voted, the recommendation is that it represents a minimum level for the next pension reform.

Keywords: Demographic change, social security reform, overlapping generation models

JEL Codes: J11, H20, H77

1 Introduction and Literature Review

Social Security is the main economic challenge for Brazil at the moment. The General Social Security System (RGPS)\(^1\) presented a deficit of R$182 billion

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1 It is the social security system that applies to private sector employees, employers, salaried employees, domestic workers, self-employed persons, individual taxpayers, rural workers, occupiers of positions of trust in public administration and public servants of municipalities that do not have their own social security system.
in 2017, an amount that will increase over time as the Brazilian population is aging. Likewise, the Social Welfare Regime (RPPS)\(^2\) of federal servants also presented a deficit of R$86 billion, which increases the fiscal difficulties of the country. In total, the Brazilian social security deficit reached R$268 billion, or 4.2% of GDP.

The Brazilian demographic change occurs rapidly, which can lead to the collapse of social security in the long term. Data from the Social Security Forum (FPS, 2017) indicate that the Brazilian birth rate will decrease to 1.3 children per woman in 2034. In parallel, life expectancy is expected to rise to 80.1 years old in 2042. Thus, a Brazilian reaching 60 years old will have a 25.2 years old survival expectation in 2060. On the other hand, IBGE (2014) projects a reduction of the economically active population from 140.9 million in 2015 to 131.4 million in 2060, with an increase in number of elderly over 65 years old from 16.1 million to 58.4 million in the same period.

The result of this process is the widening of the social security deficit if no change occurs. The Ministry of Finance (MF, 2017) estimates a sharp rise in the social security gap, which is expected to jump from the current 4% of GDP to above 11.1% of GDP by 2060. This deficit proportion would impair most of the government’s most fundamental tasks such as education, health and security.

In this scenario, the federal government presented the Constitutional Amendment Proposal (PEC) n\(^\circ\) 287/2016 that establishes a minimum age with transition rules and covers both the RGPS and RPPS of the federal servers. The minimum age for retirement would be 65 for men and 62 for women with a transition rule of 20 years. According to a study by the Ministry of Finance (MF, 2017) such measures would be sufficient to contain the increase in the social security deficit until at least 2060.

The national economic literature has warned for some time about Brazilian social security issue. Barreto (1997) already argued that the Brazilian social security system was insolvent and suggested a change from the distribution system to the capitalization regime. The author builds a model of overlapping generations (OLG) to evaluate the effects on the economy of change in the social security regime. The impacts are positive, but there is a heavy fiscal cost that must be borne during the transition from the allocation system to the capitalization system.

The change in the social security regime of capitalization distribution was

\(^2\) It is the regime applied to public servants of the Union, the States and the Federal District and also to 2052 Brazilian municipalities.
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very present in the Brazilian literature. S. G. Ferreira (2004) uses an OLG model to calculate the short-term and long-term effects of several pension reforms, with changes such as the choice between an allocation system, capitalization or intermediate situations. The author concludes that partial reforms that reduce replacement rate or exchange the tax base from work to consumption produce positive long-term effects, but a high fiscal cost remains in the transition.

Ellery and Bugarin (2003) apply an OLG model to determine the optimal relation between allocation and capitalization system, measured by the replacement rate. The authors conclude, for reasonable parameters, that the capitalization system is always preferable instead of an allocation system.

Concern about the drop in fertility and the increase in life expectancy already appeared in the text by Oliveira, Beltrão, and Ferreira (1997). The authors highlighted the legislative difficulties to approve a social security reform that was necessary at the time.

The first major change in social security since the approval of the Federal Constitution in 1988 was the approval of Constitutional Amendment 20/1998. The new legislation established the minimum contribution time of 35 years for men and 30 years for women and determined minimum retirement age in the federal public service of 60 years for men and 55 years for women. Constitutional Amendment N°20/1998 created the social security factor, together with the infraconstitutional legislation (Law 9876/99), which made it possible to reduce the benefits amounts in the RGPS.

According to Giambiagi and Estermínio (2006) and Marques, Batich, and Mendes (2003), EC 20/98 was only able to reduce the short-term deficit, but it did not represent a definitive solution for the Brazilian pension system.

The second social security reform was Constitutional Amendment N° 41 of 2003. EC 41/03 created the social security contribution of the inactive of the RPPS. Federal retirees with income above the RGPS benefit ceiling started to pay the same social security contribution as the assets. New limitations were also established within the RPPS, such as reducing the value of the benefit for employees retiring before the age of 60 (male) and 55 (female).

For Souza, Zyliberstajn, Afonso, and Fiori (2006), the impact of EC 41/2003 was very limited, focusing only on RPPS whose implied debt fell by 20% and almost null on the RGPS. Many authors begin to question the solvency of the Brazilian pension system. For Rocha and Caetano (2008) the regime presents very high expenditures in comparison with other countries, with a high number of beneficiaries, so that Brazilian social security expenditures already seemed
excessive in 2006. Matos, Melo, and Simonassi (2013) also question the solvency of RGPS in Brazil, but argue that reforms with establishment of a minimum age would be able to reverse the trajectory of the social security deficit.

As a way of balancing the social security regime, Giambiagi, Zylberstajn, Afonso, Souza, and Zylberstajn (2007) proposed the establishment of a minimum age of 60 years (male) and 55 years (female) with contribution time of 35 years old (male) and 31 years old (female) for those already in the labor market. For new entrants, establishment of minimum age of 65 for men and 64 for women, with contribution time of 40 years. The authors calculate that with these measures the implicit debt of the Brazilian social security system could fall between 40% and 60%.

Caetano et al. (2016) analyze the social security changes in Dilma Roussef’s government, especially the end of the social security factor. The authors conclude that the social security factor was able to generate savings of 2.2% of GDP per year, while the new rules will increase RGPS spending by 0.4% per year. It recommends the adoption of a reform with establishment of a minimum age of 65 for men and 60 for women.

Santos (2018) used the overlapping generations model with heterogeneous agents and incomplete markets to quantitatively evaluate pension reform (setting the minimum age for 65 years and a change in the average replacement rate from 0.82% to 40%) considering (46.1%), labor (22%) and production (30.2%), the results of the reform pointed to an increase in capital.

P. C. Ferreira and Parente (2018) uses a macroeconomic model with occupational behavior and demography to simulate two pension reforms: the first is the end of the integrality of retirement for public servants and the second proposal is the increase of the minimum age for retirement. According to the authors, for the first simulation, there is a reduction of the long-term social security deficit from 8.2% of GDP to 5%. In the second simulation using the parameters of the 2013 reform, the social security deficit will decrease to 3.5% of GDP, considering (i) unification of the retirement modalities of private and public sector workers; (ii) the minimum retirement age of 65 and 62 for men and women, respectively; and (iii) the change in the calculation of the replacement index, where a worker must contribute for at least 25 years to retire.

This paper contributes in the literature by simulating the long-term economic impacts of the increase in the minimum age for retirement presented in the Proposal for Constitutional Amendment (PEC) nº 287/2016. Therefore, a model of overlapping generations (OLG) with 57 generations will be constructed. The
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methodology used, although very common in the international literature, is little used in Brazil.\(^3\)

The results suggest that the increase in the minimum age proposed in PEC 287/2016 has relevant effects on the economy. Comparing the situation without reform with the increase of the minimum age proposed by the PEC 287/2016, from the perspective of the model, it is observed that the macroeconomic variables present a better performance with the reform, with the product, consumption and employment reaching higher levels. However, total social security deficit, which includes RGPS and RPPS, jumps from around 4.6% of GDP to 13.1% of GDP with reform and 21.6% of GDP without reform. The conclusion is that, from the perspective of the model, the reform of PEC 287/2016 may help, but it is far from solving the social security deficit.

Besides this introduction, the work counts on 5 more sections. Section 2 outlines the methodology, section 3 presents the calibration, section 4 details the Proposals of Constitutional Amendment N\(^\circ\) 287/2016 and section 5 discusses the results. Section 6 presents the final comments.

2 Methodology

This article uses a model of overlapping generations with greater detail on the fiscal side, approaching the real situation of the Brazilian economy.

Families

Families comprehend 57 overlapping generations of adults. With each period of time, there is an exit and an entrance of individuals. The entry happens at the age of 23, and the exit, happens with an expected age of death of 80 years. The assumption is that individuals start working at age 23 (when \(j = 1\), where \(j\) is the generation), retire at\(^4\) 58 (\(j = 35\)) and die at age 80 (\(j = 57\)). Life uncertainty was considered in this model when introducing the mortality rate of each family. For each family, we assume preferences represented by a utility function with the current and future values of consumption and leisure. Leisure is measured as the difference between the fraction of the maximum amount of time that an individual could work in the reference week having values between zero and one. For preferences, we use the constant elasticity of substitution


\(^4\) Average age of retirement in Brazil according to data from the Social Security Forum (2016).
Freitas and Paes

function (CES). We can represent the intertemporal utility function as follows:

$$U_t = \frac{1}{1 - \frac{1}{\gamma}} \sum_{j=1}^{57} (1 + \beta)^{-(t-1)} p_j u_{j,t} \left(1 - \frac{1}{\gamma}\right), \quad (1)$$

where:

$$u_{j,t}(c_{j,t}, l_{j,t}) = \left(c^{(1-\frac{1}{\rho})}_{j,t} + \alpha l^{(1-\frac{1}{\rho})}_{j,t}\right)^{\frac{1}{1-\rho}}, \quad (2)$$

where $\gamma$ is the intertemporal substitution elasticity; $\beta$ is the discount rate; $p_j$ is the survival probability of the individual of family $j$ (IBGE, 2017). For simplicity, the accidental inheritances left by individuals are not used by the model. The variables $c_{j,t}$ and $l_{j,t}$ represent consumption and leisure with age $j$ at time $t$. The parameter $\rho$ represents the intratemporal substitution elasticity between consumption and leisure and $\alpha$ is the weight of leisure in relation to the consumption in the preferences of the families.

Given this, we have that families maximize their intertemporal utility (equation (1)) based on their income expectations throughout the life cycle, represented by the equation below:

$$\sum_{j=1}^{35} \prod_{m=1}^{t} \left(\frac{W_t e_{j,t}(1 - l_{j,t})(1 - \tau_{lt} - \tau_{st})}{1 + r_m(1 - \tau_{kt})}\right) + \sum_{j=36}^{57} \prod_{m=36}^{t} \left(\frac{b_t}{1 + r_m(1 - \tau_{kt})}\right) + Tr_t \geq \sum_{j=1}^{57} \prod_{m=1}^{t} \left(\frac{(1 + \tau_{ct})c_{j,t}}{1 + r_m(1 - \tau_{kt})}\right). \quad (3)$$

The equation ensures that the present value of consumption over the life cycle is less than or equal to the present value of the income of individuals during the finite period of life of families. Leisure $l_{j,t}$ assumes values less than 1, for $j$ between 1 and 35; and values equal to 1 for $j$ from 36 to 57. This is due to the fact that retirees do not offer work (generation between 36 and 57). The wage in year $t$ is given by $W_t$; $(1 - l_{j,t})$ are hours worked and $e_{j,t}$ is an exogenous adjustment factor to capture differences in skill levels between families of different ages.

The tax rates are: $\tau_{lt}$, tax rate on labor income; $\tau_{kt}$, rate on capital income; $\tau_{ct}$, tax rate on consumption; $\tau_{st}$, rate of social security contributions; and $Tr_t$ are transfers from government to families.

The variable $r_t$ is the real interest rate, while $b_t$ represents transfers to
families as social security. Thus, the value of the benefit salary will be:\(^{5}\)

\[
b_t = 0.8 \sum_{j=1}^{45} \left( \frac{W_{t-j} e_j (1 - l_{j,t-j})}{45} \right).
\] (4)

Finally, solving for \(j = 1, \ldots, 35\) the maximization of the utility function subject to budget constraint, we obtain the intertemporal trajectories and the intratemporal relation of consumption and leisure, equations (5), (6) and (7), respectively:

\[
c_{j,t} = c_{j-1,t-1} \left( \frac{(1 + \beta)^{t-2}}{(1 + \beta)^{t-1}} \right) \gamma [1 + r_t (1 - \tau_{kt})] \gamma \left( \frac{p_j}{p_{j-1}} \right)^\gamma \left( \frac{1 + \tau_{ct-1}}{1 + \tau_{ct}} \right)^\gamma \\
\left( \frac{1 + \alpha^\rho (w^*_{j-1,t-1})^{(1-\rho)}}{1 + \alpha^\rho (w^*_{j,t})^{(1-\rho)}} \right)^{\frac{\alpha - \gamma}{\rho - 1}}, \quad (5)
\]

\[
l_{j,t} = l_{j-1,t-1} \left( \frac{(1 + \beta)^{t-2}}{(1 + \beta)^{t-1}} \right) \gamma [1 + r_t (1 - \tau_{kt})] \gamma \left( \frac{p_j}{p_{j-1}} \right)^\gamma \left( \frac{1 + \tau_{ct-1}}{1 + \tau_{ct}} \right)^\gamma \\
\left( \frac{1 + \alpha^1 + \rho w^*_{j-1,t-1}}{1 + \alpha^1 + \rho w^*_{j,t}} \right) \left( \frac{w^*_{j-1,t-1}}{w^*_{j,t}} \right)^\rho, \quad (6)
\]

\[
l_{j,t} = c_{j,t} \alpha^\rho w^*_{j,t} \rho, \quad (7)
\]

where

\[
w^*_{j,t} = \frac{W_t e_j (1 - \tau_{lt} - \tau_{st}) + \mu_{j,t}}{(1 + \tau_{ct})}.
\] (8)

The parameter \(\mu_{j,t}\) would be the shadow wage of family \(j\) in year \(t\) which is equal to zero if the individual offers some labor and is not equal to zero if he decides not to work in year \(t\). \(\frac{p_{t-1,j,t-1}}{p_{j,t}}\) is the conditional probability of a family of generation \(j\) living plus one unit of time.

For retirees who correspond to the generations \(j = 36, \ldots, 57\), the leisure trajectory is unitary, then, from the process of maximizing the utility function subject to the budget constraint, we have the following consumption equation:

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\(^{5}\)According to Law N°9876 of 1999, retirees by contribution time and by age will have their benefit salaries as a simple arithmetic mean of the highest contribution wages corresponding to eighty percent (0.8) of the entire contributory period.
\[
\left( \frac{c_{j,t}}{c_{j-1,t-1}} \right)^{-\left(\frac{1}{\rho}\right)} \left( \frac{c_{j,t}}{c_{j-1,t-1}} + \alpha l_{j,t}^{(1-\frac{1}{\rho})} \right)^{\left(\frac{1}{\rho}\frac{1}{\gamma}\right)/(1-\frac{1}{\rho})} - \left( \frac{1}{\rho} \right) = \left( \frac{1}{1+\tau_{ct}} \right) \left( \frac{1 + \beta}{1 + \tau_{ct-1}} \right) . \tag{9}
\]

### Production

The production function has as input capital and labor and a Cobb–Douglas technology. Capital is homogeneous, while labor is expanded by the level of efficiency \(e_j\), that is, people of different ages provide different amounts of labor per leisure unit. Thus the production function is given by

\[
Y_t = F(K_t, L_t) = A_t (K_t^\theta L_t^{1-\theta}), \tag{10}
\]

where \(Y_t\) is the aggregate product, \(K_t\) and \(L_t\) represent capital and aggregate labor, respectively. The term \(\theta\) is the share of capital in the production function and, finally, \(A_t\) represents the total factor productivity. Thus, from the process optimization of production function (10), we have the following equations of wage and interest rate:

\[
W_t = (1 - \theta) A_t \left( \frac{K_t}{L_t} \right)^\theta , \tag{11}
\]

\[
r_t = \theta A_t \left( \frac{K_t}{L_t} \right)^{\theta-1} , \tag{12}
\]

where \(\delta\) represents the rate of capital depreciation.

### Government

The government keeps the budget balanced, so that the revenues are exactly equal to the sum of government consumption with the social security deficit and transfers:

\[
G_t = T_t - S_t^B - Tr_t, \tag{13}
\]

where \(G_t\) is government consumption of goods and services, \(S_t^B\) are the benefits of social security, and \(Tr_t\) are government transfers. For the tax collection \(T_t\), we have:

\[
T_t = \sum_{j=1}^{35} N_{j,t} \tau_{lt} W_t e_j (1-l_{j,t}) + \sum_{j=1}^{57} N_{j,t} c_{j,t} \tau_{ct} + \tau_{kt}(r_t + \delta) K_t + S_t^A , \tag{14}
\]
where $S^A_t$ is the collection of social security and $N_{j,t}$ is the population of age $j$ in $t$ periods.

**Social Security**

In Brazil the social security system uses the simple distribution system (PAYG), where the benefits received from retirement extend until the death of the individual. Following the Brazilian reality, in the model the retirement occurs in $j = 37$, equivalent to 58 years of age, and the benefit value is calculated by the equation (4).

The total annual social security expenditure can be represented by the following equation:

$$S^B_t = \sum_{j=36}^{57} N_{j,t} b_t.$$  \hspace{1cm} (15)

The annual income of the social security comes from the contribution of the employees on the payroll:

$$S^A_t = \sum_{j=1}^{35} N_{j,t} W_t e_j (1 - l_{j,t}) \tau_{st}.$$  \hspace{1cm} (16)

**Marketplace balance**

The balance in the labor market requires

$$L_t = \sum_{j=1}^{35} N_{j,t} e_j (1 - l_{t,j}).$$  \hspace{1cm} (17)

The balance in the capital market is given by

$$K_{t+1} = Y_t + (1 - \delta) K_t - G_t - C_t.$$  \hspace{1cm} (18)

The equality between supply and aggregate demand is represented by equation (19):

$$Y_t = C_t + I_t + G_t,$$  \hspace{1cm} (19)

$$C_t = \sum_{j=1}^{57} c_{j,t} N_{j,t}. $$  \hspace{1cm} (20)
Solution of the Model

For the solution of the equilibrium trajectory of the economy, we used the algorithm of Broyden (1965) that numerically solves the system of nonlinear equations composed of equations (5) to (9) and (11) to (20).

3 Data and Calibration

The calibration was done with data from the National Accounts of the IBGE of 2015 and data from the Federal Revenue Secretariat of 2015. For simplicity, the product of the economy for 2015 was set at 1. The Brazilian economy in 2015 is considered as the initial steady state.

Table 1 presents the model parameters. For the calculation of participation of capital income in the product, \( \theta \), the gross operating surplus value was divided in relation to the sum of the salaries of employees and self-employed with the gross operating surplus itself:

\[
\theta = \frac{1,925,415}{(1,925,415 + 2,673,347 + 499,417)} = 0.3776. \tag{21}
\]

Consumption in proportion to GDP reached 62.50% in 2015. Government consumption and investments reached 19.77% and 17.71% respectively in relation to GDP.

The basic interest rate of the economy (SELIC) for the period was 14.15%, inflation in 2015 was 10.17% based on the broad consumer price index (IPCA), so that the real interest rate was 3.98% per year.

Table 1. Economic Aggregates (2015).

<table>
<thead>
<tr>
<th></th>
<th>Brazil 2015 in% GDP</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>62.50</td>
<td>62.50</td>
</tr>
<tr>
<td>Government Consumption</td>
<td>19.77</td>
<td>19.77</td>
</tr>
<tr>
<td>Capital</td>
<td>–</td>
<td>504.07</td>
</tr>
<tr>
<td>Investment</td>
<td>17.71</td>
<td>17.71</td>
</tr>
<tr>
<td>Selic Interest Rate</td>
<td>14.15</td>
<td>–</td>
</tr>
<tr>
<td>Real Interest Rate</td>
<td>3.97</td>
<td>3.97</td>
</tr>
<tr>
<td>Wages rate</td>
<td>62.23</td>
<td>62.23</td>
</tr>
<tr>
<td>Government revenue</td>
<td>31.23</td>
<td>31.23</td>
</tr>
<tr>
<td>Social Security revenue</td>
<td>7.15</td>
<td>7.15</td>
</tr>
<tr>
<td>Expenses on Social Security</td>
<td>10.92</td>
<td>10.92</td>
</tr>
</tbody>
</table>

Source: IBGE (2017), Ipeadata (2017), Social Security (ME, 2014) and elaboration of the authors.
For steady state capital, we use the investment value as a proportion of GDP, the real interest rate and the value of θ:

$$\bar{K} = \frac{\theta - \frac{L}{r}}{\bar{K}}. \tag{22}$$

To calculate the hours worked ($L$), we use the working hours available for the market activity. Thus, from the 168 hours per week, 56 hours of sleep per week are withdrawn, and considering a working day of 44 hours per week, $L = 44/112 = 0.3928$. The average salary reached 62.23% of GDP this year.

The values for the collection were taken from the study of the Brazilian tax burden (RFB, 2015) and social security expenditure was obtained through the Statistical Yearbook of Social Security (ME, 2014).

Table 2 presents the model parameters. Given the investments in relation to GDP and steady state capital, we can calculate the capital depreciation rate ($\delta$) as:

$$\delta = \frac{I/Y}{\bar{K}}. \tag{23}$$

The population parameter ($N_{jt}$) was collected through projection of the population by age up to 2060 (IBGE, 2014). The probability of death ($p_{jt}$) was obtained from the complete mortality table provided by IBGE-COPIS (IBGE, 2017). The other parameters were calculated endogenously or collected in the national literature.

To compute the tax rates of the model: capital income tax ($\tau_k$), labor income

<table>
<thead>
<tr>
<th>Description</th>
<th>Parameters</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intertemporal substitution elasticity</td>
<td>$\gamma$</td>
<td>0.7</td>
<td>Cavalanti and Silva (2010)</td>
</tr>
<tr>
<td>Intratemporal substitution elasticity</td>
<td>$\rho$</td>
<td>1.135</td>
<td>S. G. Ferreira (2004)</td>
</tr>
<tr>
<td>Preference for leisure in utility function</td>
<td>$\alpha$</td>
<td>0.25</td>
<td>Cavalanti and Silva (2010)</td>
</tr>
<tr>
<td>Preference for the present</td>
<td>$\beta$</td>
<td>0.025</td>
<td>Cavalanti and Silva (2010)</td>
</tr>
<tr>
<td>Total factor productivity</td>
<td>$A$</td>
<td>0.9719</td>
<td>Modelo</td>
</tr>
<tr>
<td>Capital participation in the production function</td>
<td>$\theta$</td>
<td>0.378</td>
<td>IBGE (2017)</td>
</tr>
<tr>
<td>Capital depreciation rate</td>
<td>$\delta$</td>
<td>0.035</td>
<td>Modelo</td>
</tr>
<tr>
<td>$e^{(a+bj+cj^2)}$</td>
<td>$e_j$</td>
<td>$a = -0.94410$</td>
<td>$b = 0.043836$</td>
</tr>
</tbody>
</table>

Notes: The parameters related to $e_j$ were calculated endogenously from the steady-state equilibrium equations using the Broyden algorithm 1965 as the solution. The parameter $A$ comes from the steady-state equation, $A = Y/K^{\theta}L^{1-\theta}$, where $Y$ is equal to one.
tax ($\tau_l$), social security tax ($\tau_s$) and consumption tax ($\tau_c$) were calculated on the basis of RFB (2015). Table 3 summarizes the values found for the tax rates.

**Table 3.** Tax rates.

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tau_k$ Tax rate on capital income</td>
<td>12.47%</td>
</tr>
<tr>
<td>$\tau_l$ Tax rate on labor income</td>
<td>10.66%</td>
</tr>
<tr>
<td>$\tau_s$ Tax rate on social security</td>
<td>10.33%</td>
</tr>
<tr>
<td>$\tau_c$ Tax rate on consumption</td>
<td>21.51%</td>
</tr>
</tbody>
</table>

4 A Proposed Constitutional Amendment nº 287/2016

The Constitutional Amendment Proposal (PEC) nº 287/2016 presented in its initial version a series of changes not only in Social Security, but also in Social Assistance. At this time, it was proposed to establish a minimum age for both RGPS and RPPS of 65 years old for men and 62 years old for women with 20 years of transition rule. A minimum age of 25 years old of contribution to the right to retirement was suggested. The calculation of the benefit was modified, so that it would only receive the full amount of the pension, who would contribute for 40 years for Social Security. For rural workers it was proposed to establish a minimum period of 15 years of contribution. Another proposal was to increase the age for granting the benefits to the elderly from 65 to 68 years old. Finally, the government proposed the untying of the social security floor of the minimum wage.

In its present state, January 2018, and in the face of difficulties in approving the original version of the reform, PEC 287/2016 was considerably reduced. The proposal was limited to setting a minimum age for urban workers only, with a transition rule, 15 years of contribution for the RGPS and 25 years for the RPPS, and re-calculation of the retirement value, based on the percentage of 60% for those who contributed for 15 years up to 100% for those with 40 years of contribution.

Table 4 details the main points of the proposal.

In the exercises carried out in this article, it was considered only the increase of the minimum age, not being treated other aspects of the PEC nº 287/2016. For simulations, a minimum retirement age of 63 years old was adopted, equivalent to the proposal of 65 years old for men and 62 years old for women. Since these
Table 4. Main Proposals of PEC № 287/2016.

<table>
<thead>
<tr>
<th>Proposals</th>
<th>General Social Security System (RGPS)</th>
<th>Regime of Social Security (RPPS) –Federal–</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum age – Urban</td>
<td>Men: 65 years; Women: 62 years; Contribution time: 25 years</td>
<td></td>
</tr>
<tr>
<td>Amount of Benefit</td>
<td>60% of the average of all contributions (minimum of 15 years of contribution); plus 1% for each year that exceeds 15 years of contribution time; 1.5% for each year beyond 25 years; 2% for each year beyond 30 years; and 2.5% for each year beyond 35 years until reaching 100%.</td>
<td></td>
</tr>
<tr>
<td>Increase of the Minimum Age</td>
<td>The law will establish the correction of the minimum age due to the increase in the expectation of survival</td>
<td></td>
</tr>
<tr>
<td>Transition Rule</td>
<td>Increase of minimum age from 53 years (woman) and 55 years (man) from 1 year every two years from 01/01/2020. 30% toll on what will fail to fulfill 30 years (woman) and 35 years (man)</td>
<td></td>
</tr>
<tr>
<td>Value of the benefit in the Transition (servers that entered before Constitutional Amendment № 41/2003)</td>
<td>Not applicable</td>
<td>For those who retire at age 60 (woman) or 65 (man) receive integrality and parity. If you retire before, 100% of the average.</td>
</tr>
<tr>
<td>Accommodation</td>
<td>Family quota of 50% plus 10 per dependent</td>
<td></td>
</tr>
</tbody>
</table>

are only long-term simulations, the transition proposed in PEC 287/2016 was also disregarded in the exercises.

5 Long term results

Eight simulations were carried out with two basic scenarios: in the first, there is no social security change, with the average retirement age in Brazil being maintained at 58 years old, so that the increase in the deficit is supported by four different financing alternatives - government spending, increased taxation of consumption, increased taxation of labor income and increased taxation on capital income. In the second scenario, it is considered the adoption of a minimum age as proposed by PEC 287/2016, that is, a minimum age of 63 years old, and the same alternatives of financing the scenario without reform.

In all simulations, the demographic change was estimated as estimated by IBGE (2014) with the projection of population by age in 2060. IBGE (2014) made projections for Brazilian population up to 2060, estimating a population growth of almost 27% between 2015 and 2060, but that this growth will occur disproportionately among the age groups. The number of people up to 58 years old will have decreased by 5.35%, while the number of people over 58 will have grown by 182%.
Scenario without reform

Table 5 presents the results of the long-term simulations for the scenario without any changes in social security rules.

The hypothesis in the exercises is that the adjustment be funded exclusively by a source. Thus, if the adjustment is made in government spending, the tax rates remain constant. On the other hand, if the adjustment is made in the taxation of labor, through an increase in the social security contribution, the other rates and government expenditures remain constant. Table 6 shows the values of the aliquots used in the simulations of the previous table.

The demographic transition supplemented by the increase in life expectancy of Brazilians substantially affects the Brazilian economy. In the first simulation the government finances the increase of social security transfers with the reduction of public spending. Social security spending is reduced from 11% of GDP to 28% of GDP, while government spending is reduced from 20% of GDP to 5.4% of GDP. The public sector account closes due to the 8% increase in tax revenue, due to growth in consumption.

Aggregate consumption increases, as the generations most prone to consumption, over 58 years, grow significantly. It is for this group that social security transfers are destined, that in great majority, will be applied in more consumption. On the other hand, the younger population, more likely to invest,

### Table 5. Long-term Macroeconomic Effects – Without Reform.

<table>
<thead>
<tr>
<th></th>
<th>S.S(^a)</th>
<th>Adjustment to Government Expenditures</th>
<th>Adjustment in taxation on consumption</th>
<th>Adjustment in taxation on labor</th>
<th>Adjustment to taxation on capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>0.625</td>
<td>21.28*</td>
<td>−21.25*</td>
<td>−27.80*</td>
<td>−16.91*</td>
</tr>
<tr>
<td>Government</td>
<td>0.198</td>
<td>−72.98*</td>
<td>0.00*</td>
<td>0.00*</td>
<td>0.00*</td>
</tr>
<tr>
<td>Investment</td>
<td>0.177</td>
<td>−7.94*</td>
<td>6.89*</td>
<td>14.59*</td>
<td>−3.88*</td>
</tr>
<tr>
<td>Capital</td>
<td>5.04</td>
<td>−7.94*</td>
<td>6.88*</td>
<td>14.58*</td>
<td>−3.88*</td>
</tr>
<tr>
<td>Labor</td>
<td>0.393</td>
<td>−2.60*</td>
<td>−21.88*</td>
<td>−28.81*</td>
<td>−17.84*</td>
</tr>
<tr>
<td>GDP</td>
<td>1.00</td>
<td>−4.62*</td>
<td>−11.02*</td>
<td>−12.43*</td>
<td>−12.57*</td>
</tr>
<tr>
<td>Interest rate</td>
<td>3.97%</td>
<td>3.95%</td>
<td>2.64%</td>
<td>2.05%</td>
<td>3.00%</td>
</tr>
<tr>
<td>Wages</td>
<td>0.622</td>
<td>0.21*</td>
<td>12.57*</td>
<td>19.69*</td>
<td>8.72*</td>
</tr>
<tr>
<td>Soc. Sec. Expenses</td>
<td>0.110</td>
<td>153.75*</td>
<td>129.41*</td>
<td>121.23*</td>
<td>135.17*</td>
</tr>
<tr>
<td>Soc. Sec. Revenue</td>
<td>0.064</td>
<td>−1.63*</td>
<td>−12.06*</td>
<td>−14.79*</td>
<td>−10.02*</td>
</tr>
<tr>
<td>Tax Revenues</td>
<td>0.312</td>
<td>8.05*</td>
<td>45.68*</td>
<td>42.79*</td>
<td>36.59*</td>
</tr>
<tr>
<td>Consumption per capita</td>
<td>0.625</td>
<td>−4.50*</td>
<td>−37.99*</td>
<td>−43.15*</td>
<td>−34.57*</td>
</tr>
<tr>
<td>Product per capita</td>
<td>1.00</td>
<td>−24.90*</td>
<td>−29.94*</td>
<td>−31.05*</td>
<td>−31.16*</td>
</tr>
<tr>
<td>Capital per capita</td>
<td>5.04</td>
<td>−27.51*</td>
<td>−15.84*</td>
<td>−9.77*</td>
<td>−18.68*</td>
</tr>
</tbody>
</table>

Notes: \(^a\)Initial Stationary State. *Percentage change from initial steady state.
The collapse of Brazilian Social Security

Table 6. Tax Rates – Without Reform.

<table>
<thead>
<tr>
<th></th>
<th>S.S(^a)</th>
<th>Adjustment in taxation on consumption</th>
<th>Adjustment in taxation on labor</th>
<th>Adjustment to taxation on capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax rate on consumption ((\tau_c))</td>
<td>21.51%</td>
<td>60.66%</td>
<td>21.51%</td>
<td>21.51%</td>
</tr>
<tr>
<td>Tax rate on labor income ((\tau_l))</td>
<td>10.66%</td>
<td>10.66%</td>
<td>10.66%</td>
<td>10.66%</td>
</tr>
<tr>
<td>Tax rate on social security ((\tau_s))</td>
<td>10.33%</td>
<td>10.33%</td>
<td>47.88%</td>
<td>10.33%</td>
</tr>
<tr>
<td>Tax rate on capital income ((\tau_k))</td>
<td>12.47%</td>
<td>12.47%</td>
<td>12.47%</td>
<td>68.28%</td>
</tr>
</tbody>
</table>

Notes: \(^a\) Initial Stationary State.

will decline, affecting investment. As the age for retirement has not changed, there is no extra incentive for young people to increase their savings.

The reduction of government spending and investment more than compensates for the increase in aggregate consumption, so that the effect on demand is negative. On the supply side of the factors, the impact is also negative, since the supply of capital tends to decrease, the smaller number of families willing to save, as well as the labor supply is reduced, due to the decrease in the economically active population.

In the three simulations involving increased taxation, the results are substantially lower than the simulation with reduction of public spending. The reason is that the adjustment of the public sector is done by drawing more resources from the private sector, with significant increases in taxation. If in the first simulation government spending was reduced about 15% of GDP, in the three remaining simulations this difference will have to come in the form of more tax revenues.

In the simulation in which taxation on consumption increases, aggregate consumption falls more than 20%. If, on the other hand, retirees receive the increase in social security transfers that will be used basically for consumption, on the other hand, all families will pay three times more taxes to cover the increase in social security expenditure. This increase in taxation impacts all households, but especially those still in the labor market, who are forced to react, greatly reducing consumption. These households also increase investment, since consuming has become relatively more expensive than investing.

With shrinking private consumption and a small increase in investment, demand falls significantly. In relation to the supply of factors, the supply of capital tends to increase, since the taxation of capital income has not changed, which causes families to start allocating more resources in the investment that became relatively cheaper than consumption. Labor supply tends to be reduced.
by the decrease in the economically active population due to demographic change. With more capital and less labor, wages grow and discourage even more labor supply. Another factor that negatively impacts the labor supply is the increase in consumption taxation, which by equations (7) and (8) tends to stimulate leisure—families are not willing to work more to pay consumption.

When the increase in tax burden occurs through an increase in the social security contribution, the disposable income of workers falls substantially, which is reflected in a sharp drop on private consumption. A second factor that affects consumption is that the reduction of the remuneration of net work stimulates families to increase the investment, since taxation on income of capital did not change. On the firm side, wage growth and reduction of interest rate stimulate the exchange of labor for capital.

Finally, if the adjustment is made by increasing taxation of capital income, disposable income will also be strongly affected, reflecting a decrease in consumption. Reduction in consumption, however, is less than in the previous case, since now investing has become relatively more expensive than consuming, so that families do not reduce so much private consumption. Investment decreases, due to lower net return on capital. Aggregate demand is reduced more than in other forms of financing, reflecting the demand for capital and labor.

According to the model, the four simulations result in situations of collapse for the Brazilian economy. If the adjustment to accommodate the growth of social security expenditures is done by reducing public expenditures, the government will lose any condition of maintaining a minimum of public services for population. The model therefore provides that the government will exist only for the payment of pensions.

According to the model, if the option is to increase the tax burden, which in this case will reach around 50% of GDP, the economic repercussions will be very serious. The collapse of social security in the country, predicted by the model, will imply in falls above 30% of GDP per capita and almost 40% of consumption per capita. In this scenario, by 2060 the country would be much poorer than it is today.

**Scenarios with increase of the minimum age as PEC n° 287/2016**

The establishment of a minimum age according to PEC 287/2016, attenuates the negative effects of the aging population on social security accounts. Table 7 presents the results.

As in the scenario without reform, four simulations were made considering the various forms of financing provided for in the model: reduction of public spending,
Table 7. Macroeconomic Effects of Long Term – Minimum Age.

<table>
<thead>
<tr>
<th></th>
<th>Adjustment to Government Expenditures</th>
<th>Adjustment in taxation on consumption</th>
<th>Adjustment in taxation on labor</th>
<th>Adjustment to taxation on capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>0.625</td>
<td>-3.23*</td>
<td>-7.51*</td>
<td>-3.60*</td>
</tr>
<tr>
<td>Government</td>
<td>0.198</td>
<td>0.00*</td>
<td>0.00*</td>
<td>0.00*</td>
</tr>
<tr>
<td>Investment</td>
<td>0.177</td>
<td>8.98*</td>
<td>2.30*</td>
<td>-0.70*</td>
</tr>
<tr>
<td>Capital</td>
<td>5.04</td>
<td>8.98*</td>
<td>2.30*</td>
<td>-0.70*</td>
</tr>
<tr>
<td>Labor</td>
<td>0.39</td>
<td>-5.29*</td>
<td>-8.07*</td>
<td>-3.80*</td>
</tr>
<tr>
<td>GDP</td>
<td>1.00</td>
<td>-0.14*</td>
<td>-4.29*</td>
<td>-2.63*</td>
</tr>
<tr>
<td>Interest rate</td>
<td>3.97%</td>
<td>3.35%</td>
<td>3.49%</td>
<td>3.77%</td>
</tr>
<tr>
<td>Wages</td>
<td>0.62</td>
<td>-6.70*</td>
<td>5.44*</td>
<td>4.12*</td>
</tr>
<tr>
<td>Soc. Sec. Expenses</td>
<td>0.110</td>
<td>62.31*</td>
<td>60.87*</td>
<td>61.61*</td>
</tr>
<tr>
<td>Soc. Sec. Revenue</td>
<td>0.064</td>
<td>-0.14*</td>
<td>-4.23*</td>
<td>-2.12*</td>
</tr>
<tr>
<td>Tax Revenues</td>
<td>0.312</td>
<td>22.00*</td>
<td>21.49*</td>
<td>20.03*</td>
</tr>
<tr>
<td>Consumption per capita</td>
<td>0.625</td>
<td>-24.49*</td>
<td>-27.83*</td>
<td>-24.78*</td>
</tr>
<tr>
<td>Product per capita</td>
<td>1.00</td>
<td>-22.08*</td>
<td>-25.31*</td>
<td>-24.02*</td>
</tr>
<tr>
<td>Capital per capita</td>
<td>5.04</td>
<td>-20.17*</td>
<td>-22.51*</td>
<td></td>
</tr>
</tbody>
</table>

Notes: \( ^{a}\) Initial Stationary State. \(^{\ast}\) Percentage change from initial steady state.

The increase of taxation on consumption, increase of social security contribution and increase of taxation on capital income. Table 8 presents values of aliquots used in the simulations of the previous table.

The increase of the minimum age allows the economic adjustment to be much lower than the situation without social security reform. Social security expenditure now rises from 11% of GDP to 20% of GDP, while revenue grows from 6.4% of GDP to 7% of GDP. The deficit grows to 13% of GDP, very high, but much lower than the scenario without reform. The increase in the social security deficit is financed in the first simulation by the contraction of government spending, which decreases to 12.5% of GDP.

A first point is that the labor supply does not decrease, since workers now remain in labor market for longer. The investment also grows, because with the longest working period, families spend more time accumulating capital. Therefore, on the supply side, aggregate product grows with the increase of the minimum age.

On the demand side, the increase in social security transfers to households, which grows at 9% of GDP, is largely directed at consumption, since the beneficiaries are the elderly, more likely to consume than the younger ones. Accompanying the increase in social security transfers, the increase in household income also operates in favor of more aggregate consumption. The investment
also benefits from the longer time savings of families, provided by the longest period in activity, as well, because a smaller part of the increase of the transfers ends up being destined to the investment.

Despite the positive aggregate results, according to the model, even the increase in the minimum age is not able to avoid the reduction of income per capita. The losses are lower than the unreformed scenario, but this result points out that only the increase in the minimum age to something around 63 years old will not be able to completely avoid the income loss of the population.

Adjustment by means of taxation means that the government keeps its expenses constant in real terms, so that more resources are extracted from society. As a result, the economic impact is much lower than the situation with adjustment of government spending.

The supply of factors of production is reduced relative to the situation with adjustment of government spending. The labor supply is lower, especially in the case where the taxation of labor income is increased, since the families prefer to reduce work, since part of the income gain will have to be directed to the increase of the taxation. In the same way, the supply of capital decreases when the taxation of capital income is increased. The supply of capital only increases in case of increased consumption taxation. The reason is that, in this situation, investment becomes relatively cheaper than consumption, so households reduce consumption and increase capital stock.

On the demand side, private consumption is the most affected. In the previous situation, adjustment of government spending combined with the increase in transfers allowed a high consumption growth. However, when adjustment is made via taxation, the value transferred is offset by the growth of taxes, so that households adjust income and consumption downward in face of tax increases.

As a result of higher taxation, even aggregate output declines, with severe

---

**Table 8. Tax Rates - Minimum Age.**

<table>
<thead>
<tr>
<th></th>
<th>S.S.</th>
<th>Adjustment in taxation on consumption</th>
<th>Adjustment in taxation on labor</th>
<th>Adjustment to taxation on capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax rate on consumption (τ&lt;sub&gt;c&lt;/sub&gt;)</td>
<td>21.51%</td>
<td>33.63%</td>
<td>21.51%</td>
<td>21.51%</td>
</tr>
<tr>
<td>Tax rate on labor income (τ&lt;sub&gt;l&lt;/sub&gt;)</td>
<td>10.66%</td>
<td>10.66%</td>
<td>10.66%</td>
<td>10.66%</td>
</tr>
<tr>
<td>Tax rate on social security (τ&lt;sub&gt;s&lt;/sub&gt;)</td>
<td>10.33%</td>
<td>10.33%</td>
<td>24.90%</td>
<td>10.33%</td>
</tr>
<tr>
<td>Tax rate on capital income (τ&lt;sub&gt;k&lt;/sub&gt;)</td>
<td>12.47%</td>
<td>12.47%</td>
<td>12.47%</td>
<td>33.17%</td>
</tr>
</tbody>
</table>

Notes: a. Initial Stationary State.

---
impacts on variables per capita. According to the model, the choice of taxation to finance social security expenditures, even with the increase of the minimum age, is extremely worrisome for the country.

Sensitivity Analysis
To test the sensitivity of the results in relation to the parameters, the intertemporal substitution elasticity, $\gamma$, and the preference for leisure in the utility function, $\alpha$, were chosen. Both were chosen because they were not calibrated and their values in the simulation base scenario were taken from literature. Thus, the simulations were repeated for different values of these two parameters. Tables 9 and 10 present the results. Only the results referring to the adjustment of government expenditures were presented.

In relation to the elasticity of intertemporal substitution, Havranek, Horvath, Irsova, and Rusnak (2015) present estimates for 104 countries based on 169 studies published in different periods. The average found for all studies was 0.5. However, half the published work refers to the United States. When the average between countries is considered, the elasticity value rises to 0.7. Interestingly, that for Brazil, the estimate was 0.107 with a standard deviation of 0.093. As the baseline scenario, given by the calibration, already contemplates $\gamma = 0.7$, the sensitivity analysis tested the other two values $-0.2$ and $0.5$.

Regarding leisure preference, national literature presents different values for this parameter. For example, Paes (2011) uses 2.02, while Araújo and Ferreira (1999) use 1.4; Paes and Bugarin (2006), 1.94 and Pereira and Ferreira (2010), 0.94. In the sensitivity analysis, values between 0.5 and 2.0 were considered, within the range adopted by the Brazilian literature.

The base scenario, given by the calibration, appears in bold in the table. Economic theory suggests that the lower the elasticity of intertemporal substitu-

<table>
<thead>
<tr>
<th>$\gamma$</th>
<th>$\alpha$</th>
<th>$K$</th>
<th>$L$</th>
<th>$Y$</th>
<th>$C$</th>
<th>$G$</th>
<th>$S_b$</th>
<th>$S_a$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0.25</td>
<td>-32.34</td>
<td>-22.32</td>
<td>-26.27</td>
<td>-5.83</td>
<td>-85.17</td>
<td>103.30</td>
<td>-26.27</td>
</tr>
<tr>
<td>0.5</td>
<td>0.25</td>
<td>-23.48</td>
<td>-21.31</td>
<td>-22.14</td>
<td>-3.11</td>
<td>-81.01</td>
<td>105.85</td>
<td>-22.14</td>
</tr>
<tr>
<td>0.7</td>
<td>0.25</td>
<td>-7.94</td>
<td>-2.6</td>
<td>-4.62</td>
<td>21.28</td>
<td>-72.98</td>
<td>153.75</td>
<td>-1.63</td>
</tr>
<tr>
<td>0.7</td>
<td>0.5</td>
<td>-20.01</td>
<td>-38.13</td>
<td>-31.83</td>
<td>-15.15</td>
<td>-94.94</td>
<td>100.51</td>
<td>-31.83</td>
</tr>
<tr>
<td>0.7</td>
<td>1.0</td>
<td>-11.44</td>
<td>-59.05</td>
<td>-45.20</td>
<td>-32.14</td>
<td>-100.00</td>
<td>97.01</td>
<td>-45.20</td>
</tr>
<tr>
<td>0.7</td>
<td>1.5</td>
<td>10.77</td>
<td>-68.93</td>
<td>-49.78</td>
<td>-41.74</td>
<td>-100.00</td>
<td>101.53</td>
<td>-49.78</td>
</tr>
<tr>
<td>0.7</td>
<td>2.0</td>
<td>336.98</td>
<td>-55.16</td>
<td>5.94</td>
<td>-52.37</td>
<td>-100.00</td>
<td>142.59</td>
<td>5.94</td>
</tr>
</tbody>
</table>
Table 10. Sensitivity Analysis – Minimum Age and Adjustment in Government Expenditures.

<table>
<thead>
<tr>
<th>$\gamma$</th>
<th>$\alpha$</th>
<th>$K$</th>
<th>$L$</th>
<th>$Y$</th>
<th>$C$</th>
<th>$G$</th>
<th>$Sb$</th>
<th>$Sa$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0.25</td>
<td>6.31</td>
<td>-4.30</td>
<td>-3.42</td>
<td>-8.47</td>
<td>-45.97</td>
<td>60.84</td>
<td>-4.02</td>
</tr>
<tr>
<td>0.5</td>
<td>0.25</td>
<td>7.00</td>
<td>-4.02</td>
<td>-1.79</td>
<td>-3.44</td>
<td>-38.06</td>
<td>61.20</td>
<td>-1.79</td>
</tr>
<tr>
<td>0.7</td>
<td>0.25</td>
<td>7.46</td>
<td>5.66</td>
<td>9.15</td>
<td>27.20</td>
<td>-22.33</td>
<td>82.47</td>
<td>9.15</td>
</tr>
<tr>
<td>0.7</td>
<td>0.5</td>
<td>6.77</td>
<td>-20.84</td>
<td>-11.37</td>
<td>-20.12</td>
<td>-33.71</td>
<td>77.59</td>
<td>-11.36</td>
</tr>
<tr>
<td>0.7</td>
<td>1.0</td>
<td>28.20</td>
<td>-39.61</td>
<td>-19.75</td>
<td>-39.63</td>
<td>-43.60</td>
<td>93.77</td>
<td>-19.75</td>
</tr>
<tr>
<td>0.7</td>
<td>1.5</td>
<td>62.30</td>
<td>-48.33</td>
<td>-20.39</td>
<td>-50.34</td>
<td>-100.00</td>
<td>167.51</td>
<td>-20.39</td>
</tr>
<tr>
<td>0.7</td>
<td>2.0</td>
<td>117.16</td>
<td>-51.83</td>
<td>-14.93</td>
<td>-57.18</td>
<td>-100.00</td>
<td>263.50</td>
<td>-14.93</td>
</tr>
</tbody>
</table>

 tion, the lower the household savings, so that they begin to value the present consumption more to the detriment of future consumption. This actually did appear in the results, with the economy moving into a long-run equilibrium with a sharp drop in capital stock, which is reflected in reduced output and aggregate consumption. Therefore, if families are more impatient about the future, the economic consequences of population aging will be worse.

Regarding changes in preference for leisure, it is expected that the increase in the values of this parameter has quite negative effects on labor supply, accompanied by a reduction in private consumption. The results confirm this behavior, however, government spending becomes zero from $\alpha = 1$. This implies the complete collapse of government, so that the results no longer have economic sense.

As in the sensitivity analysis of the scenario without reform, with the change in the minimum age, the pattern was exactly the same: lower savings for lower values of intertemporal substitution elasticity and lower labor supply and private consumption for higher values of preference for leisure, $\alpha$.

6 Final Comments

With an overlapping generation model, this study analyzed the impact of the increase of the minimum age for retirement on the Brazilian economy. There is a strong increase in the social security deficit, which is expected to jump from the current 4% of GDP to above 11.1% of GDP in 2060. It was considered in the simulations that Proposition Nº287/2016 of Constitutional Amendment would be approved. This proposal basically establishes a minimum age for retirement in Brazil.

The results suggest that not doing retirement is a very bad choice for society. According to the model, the fiscal situation becomes unsustainable, and the
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expansion of social security expenditures in combination with the reduction of the labor supply leads the country to a scenario of a sharp decline in consumption per capita and consumption.

On the other hand, the simulations indicate that the increase in the minimum age proposed in PEC 287/2016 is not the definitive solution to the Brazilian social security issue. The model results indicate that raising the minimum age prevents a very bad scenario, but does not seem to be able to maintain the current product level per capita.

As a policy suggestion, although PEC Nº 287/2016 has not even been voted on, the recommendation is that it represents a minimum level of pension reform. In addition, it would be desirable that a more restrictive reform, which would raise the minimum retirement age even further, should be proposed to have a longer lasting effect on the economy.

References


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