# Demographic transition: the impact on Brazilian labor market

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Demographic changes are affecting direct and/or indirectly the world economy. In Brazil, according to the United Nations (2015) data, the population over 65 years old represented 7.8% of the total population in 2015, and the forecast is that by the year 2030 this frame will reach 13.5%. With a relative increase in the elderly population and a fall in the young population, the hypothesis is that an impact will occur in the labor market and to capture these changes in the economy, a computable general equilibrium model was used.

The model used was called MID (Labor Market-Immigration-Demography-Brazil) which follows the ORANI models (Dixon et al., 1982) of the Johansen type (1960). The model is composed of 62 Brazilian productive sectors that produce one or more of the 128 products from the combination of different inputs and the Brazilian input output matrix of the year 2011 was used. The final demand is made up of investors, families, foreign consumers, government and stock variation. The margins, which have the function of facilitating the flow of domestic production, are composed of 4 types and there are three types of indirect taxes. For production, capital, land and labor are used, which may be Brazilian or foreign, as primary inputs. The composition of the primary factor there is an imperfect substitution via price, following Armington's hypothesis (1969), controlled by a technology by function CES (Constant Elasticity of Substitution) between capital, labor and land. There is also a substitution between the labor factor that also follows the CES function among workers of different schooling and age group, being, in this way, possible to capture the effect in the Brazilian economy of demographic changes.

It was necessary to calibrate the model with the different substitution of elasticity between Brazilian workers of different age groups and schooling for the 62 sectors analyzed. To do this, the first step was to subdivide the work force into three qualification levels (low, medium and high) and four age groups (young, adult, mature and elderly) in order to calculate the elasticity of substitution of Brazilian workers in 62 sectors using the econometric methodology proposed by Das (2003).

In order to find the workers' elasticity of substitution, the RAIS-Migra database was used, which is a database extracted from the Annual Social Information Relation (RAIS) of the Ministry of Labor and Employment (MTE). The variables used were the worker's income, main activity, besides age and schooling, and the years chosen were between 1997 and 2008, the latter being available.

As a first result it was possible to perceive that the workers present different degrees of substitution, for the different sectors, schooling and age group. In general, it was observed that the young workers have the lowest elasticity of substitution, while the mature ones obtained the highest elasticities. These results show the greater vulnerability of mature workers to being replaced by other age groups. In addition, the result points out that there is an imperfect substitutability among workers and that the demographic transition tends to deepen this effect over the years

After the MID-BR (Labor Market-Immigration-Demography-Brazil) model was calibrated, it was possible to carry out simulations in order to capture the effects that the demographic transition causes in the Brazilian economy. Two studies were carried out, the first being the addition of 1% of the Brazilian labor factor in a homogeneous way.

The uniform increase of workers did not lead to similar variations in the labor price among the age groups, showing, in this case, that the share of older workers had the greatest negative impact on wages. These results take into account the substitution elasticities among the workers calculated in this paper. With the demographic transition that the country undergoes, this result shows that even if the labor growth were homogeneous, as the simulation was carried out, the young workers would be the segment with lower wage losses. The opposite would be the case of older workers, such as the mature and the elderly, who are the fastest growing in the country

The second study had as main objective to compare the influence of workers' schooling on the economy. For this, three simulations were performed and a separate shock of 1% in the labor factor was given in each one of the schooling. It was observed that the increase of 1% of workers with low schooling added 0.2% to the Brazilian GDP. When the increase was for workers of average schooling, the GDP increased by 0.31% and 0.34% for the high. It should be noted that the percentage of low-educated workers, according to RAIS, is 43.3%, 43.7% for the average and 13% for high-income workers. In this way, it was observed that a lower absolute number of highly educated workers leads to greater economic growth in the Brazilian economy.