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Labor supply, employment and growth. A empirical study with data panel in 74 countries between 1990-2014

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Dissertação submetida ao Programa de Pós-Graduação em Economia da Faculdade de Ciências Econômicas da UFRGS, como requisito parcial para obtenção do título de Mestre em Economia, com ênfase em Economia Aplicada.

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Dedico este trabajo a mis padres

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Leonardo Padura

Resumo

Na atualidade existe uma necessidade de repensar políticas voltadas para o desenvolvimento devido a que o milagre resgitrado por os *baby boomers* no século passado começa a desaparecer. Por isto, o objetivo deste trabalho é medir o impacto econômico e demográfico dos *elderly boomers* sobre o crescimento económico, adicionando duas variáveis na equação geral de Solow-Swan. Além disso, medir o impacto da participação das mulheres na força de trabalho como uma das fontes possível para mitigar este declínio (separado por edade e sexo). Os principais ressultados foram: que evidenciá-se una redução do 34% no crecimento explicado pelo factor puramente demográfico (força laboral) em relação com o observado nos anos 80-90. Evidenciá-se também para o grupo de mulheres maiores de 25+ que tem um coeficiente negativo -0,24 (cresciemnto taxa de emprego) sobre o crescimento econômico (PIB per-capita), isto deve-se a que embora as mulheres tenham um maior crescimento em sua força laboral do que os homens, as mulheres empregadas não cresce na mesma proporção, isto em grande parte pela fraqueça institucional e ausência apertura econômica ainda na maioria dos países.

Palavras-chave: Crescimento econômico. Dividendo demográfico. Oferta de trabalho.

Abstract

At present there is a necessity to rethink development policies because the miracle registered by the baby boomers in the last century begins to disappear. For this reason, the objective of this work is to measure economic and demographic impact of elderly boomers on economic growth by adding two variables in the general Solow-Swan equation. Also, measuring the impact of women participation in the workforce as one of the possible ways to mitigate this decline (disaggregate by sex and age). The main results were: a 34% reduction in growth explained by the purely demographic factor (labor force) in relation to the observed in the years 80-90. To group of women over 25+ who have a negative coefficient -0.24 (growth rate of employment) on economic growth (GDP per-capita), this is due to the fact that although women have a higher labor force growth than men, the number of women employments do not increase in the same proportion, this is largely due to institutional weakness and lack of economic openness in most countries.

Keywords: Economic Growth. Demographic dividend. Labor supply.

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1 INTRODUCTION

Studies in demography have gained the attention of growth experts over the past 30 years, perhaps a little more, due to the importance of its increasingly noticeable effect on the growth of the economy. Many times this effect went unnoticed, because specific factors are needed to be potentialized and exploited, which go through institutional strength, culture and education, to mention just a few. Thus, the important concern in this issue is due to the fact that social security and equity policies such as the health system, retirement, gender could not be planned without understanding this area.

In the same vein, our work wants to focus on these last lines, to understand how to mitigate the current economic decline that is representing the rapid aging of the workforce. Although it is important to clarify that in some countries it is more severe than in others, it is important to understand in any way the causes of this current brake. What is causing it, how to address this to generate the least negative impact and facing the future, how to compensate. For this reason, we find it relevant to understand the purely demographic effect, the evolution of employment-because it has a more direct relationship with growth than the purely demographic effect-, the inclusion of women, the role and participation in the labor force of them and the increase of retirement age as mitigators of the effect generated by this transition. In this way, we include control variables to measure possible deviations that could be derived from demographic and employment behaviour on economic growth (per capita GDP).

In other words, the decline in birth and death rates means that dependent cohorts are larger than the labor force. That it is to say, more and more older and less able adults will be able to replace the outgoing work force. This brings to the table a series of concerns and conjectures about the impact of these natural and social changes on the economies of the countries.

According to the average fertility scenario projected by the United Nations, it is expected that by 2020, those over 60 will reach 1 billion, and 2 billion by 2050, representing 22% of the world's population. In addition, the population over 80 years old, is expected to be about 4% by 2050. While this change is long-term, looking back to the past can be seen as an unprecedented and increasingly accelerated phenomenon. The 60+ and 80+ groups share a larger proportion in the world than ever recorded in history. The population over 60+ years old will have grown from 200m in 1950 to 760m to the present day, and is expected to be about 2 billion by 2050. The number of over 80+ has grown from 14m in 1950 to 110m to the present day, and will be 400m in 2050. It is important to clarify that in scenarios of lower fertility projections this growth will be even more marked.

In addition, the phenomenon of global aging, of course, is not uniform across countries and varies substantially between developed and undeveloped countries. According to the United

Nations, 20% of the population in the developed countries is over 60 years old, and according to current forecasts, their proportion will increase by about 30% in the next 40 years. In developing countries, less than 10% of the population is over 60 years old, but according to current forecasts that will change soon, for example by 2050, the expected proportion would more than double.

There are three factors behind this past and projected growth for the 60+ and 80+ population groups. First, declining fertility rates have been reducing the relative number of young people and increasing the proportions of older cohorts. According to United Nations, the fertility rate has fallen from about 5 children per woman in 1950 to 2.5 in 2005, and this is projected to fall to 2 children per woman by 2050 (United Nations, 2009).

The second factor is relative to recent growth in life expectancy. The overall life expectancy of the United Nations has grown 18 years from 1950 to today (47-65). And it is expected to be in the 75s by 2050. Combined with decreasing fertility rate, this will result in a sharp increase in the proportion of the oldest over the total population.

The third factor behind the aging population relates past variations between birth rates and death rates. For example, in the developing world, some cohorts in particular result from combining high fertility rates in the presence of a rapid decline in infant mortality. It has been shown that they have moved to the group of adults over 60 years.

The aging of the working population in the world demands the introduction of relevant political changes. And the earlier these are, the better prepared countries will be to deal with the social, political, and economic effects of an impending altered structure of the population.

In this spirit, this article intends to contribute with four aspects: (i) to explore the use of different functional forms, derived from the conventional form of the Solow-Swan model of economic growth. Working directly with growth figures in employment rather than the growth of the workforce. (ii) Incorporate indicators contained in the Penn Table database. (iii) Measure the impact of the incursion in terms of labor equality for women on economic growth, as a social measure to mitigate the increase in the aging of the population. Also, evaluating the possibility of extending age of retire pensions and their effect in per capita output. (iv) To observe the changes and impacts that this global phenomenon will have in Latin America.

2 THE THEORETICAL FRAMEWORK

In this chapter we will make a brief summary of the literature that from our perspective has contributed with greater relevance to the debate of demographic transitions. In the first instance we would like to mention the first articles that helped to understand, formalize and define the phenomenon that in more recent years would become a demographic bonus in terms of growth. The studies of (COALE; HOOVER, 1958), (EHRLICH, 1970) evidenced that the rapid population growth would generate a negative impact on the economic growth. Absorbing any increase in technological development and capital accumulation. This is what is defined as "pessimistic population". On the other hand, in later studies, such as that of (BOSERUP, 1981), (KUZNETS, 1967) and (SIMON, 1981) sufficient evidence was found for the opposite, a positive relationship, defined as "optimistic population". Because rapid population growth between countries captures economies of scale and promotes technological and institutional innovation as outlined by the authors. However, (BLOOM; FREEMAN, 1986) and (KELLEY, 1988) they found no significant, positive or negative evidence of rapid population growth over economic growth.

An important contribution to remarkable was of (KELLEY; SCHMIDT, 1995). They noted that the separate impacts of births and deaths are notorious but offset in earlier periods. In contrast, short-run costs (benefits) of births (mortality reduction) increase (decrease) significantly in the 1980s, and the favorable labor-force impact of past births are not fully compensatory.

Already in the 80's it was recognized that the demographic bonus would not come only from a rapid demographic explosion without understanding the movements within the age structure. So how (BLOOM; WILLIAMSON, 1998) they segmented the ages and included demographic controls in Asia to understand how much of this country's growth (which was about double digits for 30 years) could have been explained by the purely demographic effect. They concluded that on average it represented 30 years of growth.

At this point, is observable the problem that will generate the aging of the baby boomers on economic growth. That is why (BLOOM; CANNING; GRAHAM, 2003) adding health and longevity to a general life-cycle saving model, they showed that given reasonable assumptions, increases in life expectancy generates to higher savings rates in each age group, even when retirement is endogenous. In a stationary population, these high rates are offset by an increase in dependent adult ages, but during the phase of imbalance, when longevity is rising, the aggregate effect on savings rates may be substantial. It is important to clarify that this connection was noted by (CASS, 1972) when offers a noticeable advance on the understanding of the problem of over-accumulation of capital. In this, the author emphasizes the close relationship that must exist the sequences of consumption that maintains a stock market at least as great as the possible paths of growth based on the long-term efficiency.

To articulate and summarize the main problems of aging and their effects on the economy, (BOSWORTH; BRYANT; BURTLESS, 2004) review the existing economic literature on the macroeconomic and asset market effects of population aging, focusing on four related issues: 1) The impact of the age structure on household saving, 2) the effect of the dependent adult population on investment demand, 3) evidence on the influence of the age structures on asset prices and returns, and 4) the impacts of globalization on demographic transitions.

Two important contributions are by (BÖRSCH-SUPAN; LUDWIG; WINTER, 2006) and (ATTANASIO; KITAO; VIOLANTE, 2007) both works measure the impact of babys boomers retire on social security and his necessary reform.

The former indicate that capital flows from rapidly ageing regions to the rest of the world will initially be substantial, yet that trends are reversed when households decumulate savings.

The latest indicate a main conclusions, is that if one is interested in quantifying the path of the fiscal variables (e.g., the value of the payroll tax) needed to keep the social security system viable or to finance a transition towards a fully funded system, then these two benchmarks yield similar results. However, if the focus is on quantifying the path of factor prices, aggregate variables and, ultimately, welfare, then the two approaches can diverge significantly.

Now, it becomes evident that a pension reform is needed to mitigate these changes in the ages structures. Also, a question that is disaggregated from these studies is that to achieve a sustainable and functional reform must be studied in depth and take into account the relationship between productivity and economic growth. (FEYRER, 2007) and (BLOOM; SOUSA-POZA, 2013); population aging will be the dominant feature of the global demographic scenario in the coming decades, raising concerns about labor productivity and economic performance at the individual, business and macroeconomic levels. For this reason, the relationship between labor demography and aggregate productivity is examined. Changes in the age structure of the labor force are significantly correlated with changes in aggregate productivity.

Another important factor in productivity and growth is to observe the role of women in the labor market, their participation and inclusion within the labor market. This could be a powerful tool to mitigate the accelerated aging of baby boomers. (BLOOM et al., 2009) estimates the effect of fertility on the female labor force in a data panel, instrumentalizing fertility with the existing abortion legislation in each country. They found that by reducing legal restrictions on abortion, they increase the supply of the female labor force, and thus contribute significantly to economic growth during demographic transitions when fertility decreases. (BLOOM; CANNING; FINK, 2010) behavioural responses (including greater female labour-force participation) and policy reforms (including an increase in the legal age of retirement) can mitigate the economic consequences of an older population.

For Reher ((REHER, 2007),(REHER, 2011)), the great cultural transformations underway in modern societies are the result of changes in the social role of women, the triumph of secularism, individualism and consumerism. The first being considered by the author as the most important social change Of the second half of the twentieth century. It should be noted that the last sixty years have also been marked by accelerated economic growth and diversification of the productive process. The interrelationship between the two dynamics remains a very important subject ((JONES, 2011)), which is the subject of study in this book.

Another important work to the understanding of the aging and its effect in the long term was the one that realized by (EGGLESTON; FUCHS, 2012) and (PRETTNER, 2013). The first one work developed and explain the idea why today the elderly bommers can save and gain more late in life than in other periods of time. The latest, pointing out that population aging fosters long-run growth in the endogenous growth framework, while its effect depends on the relative change between fertility and mortality in the semi-endogenous growth framework.

Inevitable population aging and slower population growth will affect the economies of all nations in ways influenced by cultural values, institutional arrangements, and economic incentives. Two recently work point out possibles future research fields (DOLLS MATHIAS; SOMER, 2015) and (LEE, 2016) the latest emphasizes the focus of attention on future research: Fertility, mortality, and possibly health status, Inter-generational transfers, Age at retirement, Global perspective and Technological progress and endogenous growth. The former point out the future issues with fiscal sustainability, focusing in wage reactions in a restrictive fiscal environment.

3 THE EMPIRICAL STRATEGY

Next we will describe in a summarized way the models worked:

3.1 Solow-Swan Model

The economy consists of a single good that can be used either for consumption or investment. This good is produced by labor L and capital K in a process described by a neoclassical production function $Y(t) = F(K(t), L(t))$. This means that F has constant returns to scale, $F(\lambda K, \lambda L) = \lambda F(K, L)$, for all $\lambda > 0$, positive and diminishing marginal returns, $F_K > 0, F_{KK} < 0, F_L > 0, F_{LL} < 0$ (where subscripts denote partial derivatives), and satisfies the Inada conditions $\lim_{K\to 0} F(K) = \lim_{L\to 0} F(L) = +\infty, \lim_{K\to +\infty} F(K) = \lim_{L\to +\infty} F(L) = 0$. The condition of constant returns to scale implies that output can be written as $Y = F(K, L) = LF(K/L, 1) = Lf(k)$, where $k \equiv K/L$ is the capital-labor ratio, $y \equiv Y/L$ is per capita output, and the function $f(k)$ is defined to equal $F(k, 1)$. The production function expressed in intensive form is $y \equiv f(k)$. Moreover, $f(0) = 0, f(\infty) = +\infty, f'(0) = +\infty, f'(\infty) = 0, f'(k) > 0, f''(k) < 0$, for all $k > 0$.

The net increase in the stock of physical capital equals gross investment less depreciation, $\dot{K} = I - \delta K = sF(K, L) - \delta K$, where $\dot{K}$ denotes differentiation with respect to time, s is the fraction of output that is saved, δ is the depreciation rate. The change in capital stock over time is given by $\dot{K}/L = sf(k) - \delta k$. Using the condition $\dot{k} = (d/d(t))K/L = \dot{K}/L - (\dot{L}/L)k$ and substituting into the previous equation, we get $\dot{K} = sf(K) - (\delta + \dot{L}/L)K$.

If $\dot{L}/L$ is constant, say n, then we have the well-known Solow–Swan model. Its fundamental dynamic equation is $\dot{k} = sf(k) - (\delta + n)k$.

Our model will not assume that the total growth rate of population n is constant, but dynamic $n(t)$ and is strictly decreasing to zero. In addition, we will segment it into two groups, dependent and independent forces, observing the effects each of these age structures. Additionally, we will compare the growth rate by age with the rate of growth of employment to see if the endogenous and institutional policies are generating the macroeconomic environment necessary to materialize this growth. Finally, we will use several demography (Asian Development Bank, 1997) and economic controls for understand the change in per capita output.

3.2 The linear Panel Model

The basic linear panel models used in econometrics can be described through suitable restrictions of the following general model:

$$y_{it} = \alpha_{it} + \beta_{it}^T x_{it} + u_{it} \tag{3.1}$$

where $i = 1, ...n$ is the individual (group, country $\cdots$) index, $t = 1, ...T$ is the time index and u_{it} a random disturbance term of mean 0.

Of course u_{it} is not estimable with $N = n \times T$ data points. A number of assumptions are usually made about the parameters, the errors and the exogeneity of the regressors, giving rise to a taxonomy of feasible models for panel data.

The most common one is parameter homogeneity, which means that $\alpha_{it} = \alpha$ for all i, t and $\beta_{it} = \beta$ for all i, t. The resulting model

$$y_{it} = \alpha + \beta^T x_{it} + u_{it} \tag{3.2}$$

is a standard linear model pooling all the data across i and t.

To model individual heterogeneity, one often assumes that the error term has two separate components, one of which is specific to the individual and doesn't change over time [1]. This is called the unobserved effects model:

$$y_{it} = \alpha + \beta^T x_{it} + \mu_{it} + \epsilon_{it} \tag{3.3}$$

The appropriate estimation method for this model depends on the properties of the two error components. The idiosyncratic error ϵ_{it} is usually assumed well-behaved and independent of both the regressors x_{it} and the individual error component μ_{it}. The individual component may be in turn either independent of the regressors or correlated. If it is correlated, the ordinary least squares (ols) estimator of β would be inconsistent, so it is customary to treat the μ_i as a further set of n parameters to be estimated, as if in the general model $alpha_{it} = \alpha_i$ for all t. This is called the fixed effects (a.k.a. within or least squares dummy variables) model, usually estimated by ols on transformed data, and gives consistent estimates for β.

If the individual-specific component μ_i is uncorrelated with the regressors, a situation which is usually termed *random effects*, the overall error μ_i also is, so the OLS estimator is consistent. Nevertheless, the common error component over individuals induces correlation across the composite error terms, making OLS estimation inefficient, so one has to resort to some form of feasible generalized least squares (GLS) estimators. This is based on the estimation of

[1] Comprehensive treatments are to be found in many econometrics textbooks, e.g. (BALTAGI, 2001) or (WOOLDRIDGE, 2010): the reader is referred to these, especially to the first 9 chapters of (BALTAGI, 2001)

the variance of the two error components, for which there are a number of different procedures available.

If the individual component is missing altogether, pooled OLS is the most efficient estimator for β. This set of assumptions is usually labelled *pooling* model, although this actually refers to the errors' properties and the appropriate estimation method rather than the model itself. If one relaxes the usual hypotheses of well-behaved, white noise errors and allows for the idiosyncratic error ϵ_{it} to be arbitrarily heteroskedastic and serially correlated over time, a more general kind of feasible GLS is needed, called the *unrestricted* or general gls. This speciffication can also be augmented with individual-specific error components possibly correlated with the regressors, in which case it is termed *fixed effects* GLS.

The hypotheses on parameters and error terms (and hence the choice of the most appropriate estimator) are usually tested by means of:

a) *pooling* tests to check poolability, i.e. the hypothesis that the same coefficients apply across all individuals,
b) if the homogeneity assumption over the coeffcients is established, the next step is to establish the presence of unobserved effects, comparing the null of spherical residuals with the alternative of group (time) specific effects in the error term,
c) the choice between fixed and random effects specifications is based on Hausman-type tests, comparing the two estimators under the null of no significant difference: if this is not rejected, the more efficient random effects estimator is chosen,
d) even after this step, departures of the error structure from sphericity can further affect inference, so that either screening tests or robust diagnostics are needed.

3.2.1 Hausman Test

Hausman is a general implementation of Hausman's (1978) specification test, which compares an estimator $\hat{\theta_1}$ that is known to be consistent with an estimator $\hat{\theta_2}$ that is efficient under the assumption being tested. The null hypothesis is that the estimator $\hat{\theta_2}$ is indeed an efficient (and consistent) estimator of the true parameters. If this is the case, there should be no systematic difference between the two estimators. If there exists a systematic difference in the estimates, you have reason to doubt the assumptions on which the efficient estimator is based.

3.2.2 Unobserved effects test

The unobserved effects test Wooldridge ((WOOLDRIDGE, 2010), 10.4.4), is a semiparametric test for the null hypothesis that $\sigma^2_\mu = 0$, i.e. that there are no unobserved effects in the residuals. Given that under the null the covariance matrix of the residuals for each individual is diagonal, the test statistic is based on the average of elements in the upper (or lower) triangle of its estimate, diagonal excluded: $n^{(1/2)} \sum_{i=1}^{n} \sum_{t=1}^{T-1} \sum_{s=t+1}^{T-1} \hat{\mu_{it}} \hat{\mu_{is}}$ (where are the $\hat{\mu}$ pooled

OLS residuals), which must be "statistically close"to zero under the null, scaled by its standard deviation:

$$W = \frac{\sum_{i=1}^{n} \sum_{t=1}^{T-1} \sum_{s=t+1}^{T} \hat{\mu_{it}} \hat{\mu_{is}}}{[\sum_{i=1}^{n} (\sum_{t=1}^{T-1} \sum_{s=t+1}^{T} \hat{\mu_{it}} \hat{\mu_{is}})^2]^{(1/2)}}$$

This test is (n-) asymptotically distributed as a standard Normal regardless of the distribution of the errors. It does also not rely on homoskedasticity. It has power both against the standard random effects specification, where the unobserved effects are constant within every group, as well as against any kind of serial correlation. As such, it "nests"both random effects and serial correlation tests, trading some power against more specific alternatives in exchange for robustness. While not rejecting the null favours the use of pooled OLS, rejection may follow from serial correlation of different kinds, and in particular, quoting (WOOLDRIDGE, 2010), "should not be interpreted as implying that the random effects error structure *must* be true".

4 DATA BASE

Our econometric analysis is based on 74 countries around the world and covers the period between 1990 and 2014. Our selection of countries was based principally on the best possible information we could get from official and specialized sources. Table 1 shows a detailed description of the countries selected. In general, our information was obtained from the World Bank Data Base, International Labor Organization (ILO Data Base), Penn World Tables and the Federal Reserve of US. The data base includes every country for which all the data exist.

This work was based mainly on the selection of variables suggested by (Asian Development Bank, 1997) to analyze the demographic changes that occurred in the last 24 years and showing the theoretical postulates currently discussed. Table 2 shows a detailed description of the variables and their sources. It also shows a summary of key descriptive statistics.

Tabela 1 – List of Countries Included in the Data Base

Argentina	Guinea-Bissau	Paraguay
Australia	Guyana	Peru
Austria	Honduras	Philippines
Bangladesh	Hong Kong SAR, China	Portugal
Belgium	India	Senegal
Bolivia	Indonesia	Sierra Leone
Botswana	Ireland	Singapore
Brazil	Israel	South Africa
Cameroon	Italy	Spain
Canada	Jamaica	Sri Lanka
Chile	Japan	Sweden
China	Jordan	Switzerland
Colombia	Kenya	Syrian Arab Republic
Costa Rica	Korea, Rep.	Thailand
Denmark	Malawi	Trinidad and Tobago
Dominican Republic	Malaysia	Tunisia
Ecuador	Mali	Turkey
El Salvador	Mexico	Uganda
Finland	Netherlands	United Kingdom
France	New Zealand	United States
Gambia, The	Nicaragua	Uruguay
Germany	Niger	Venezuela, RB
Ghana	Norway	Zambia
Greece	Pakistan	Zimbabwe
Guatemala	Papua New Guinea	

Source: Authors' Elaboration (2017).

Tabela 2 – Variable Definitions and Selected Descriptive Statistics

Cod	Variable	Source	Mean	SD	Min.	Max.
ABd	Birth Rate	WBD	27.16	11.56	6.9	56.77
ADR	Death Rate	WBD	8.62	3.67	3.45	27.68
ADu	Asia Dummy	WBD	0.19	0.39	0	1
AGP	Average Growth Population (1975-1985)	WBD	1.88	1.06	-0.15	3.76
AIR	Infant Death Rate	WBD	31.06	31.74	1.4	156.5
AIN	Noninfant Death Rate	WBD	8	2.76	3	21
APD	Acces Ports Dummy	WBD	0.15	0.36	0	1
DGR	Difference Growth Rates	WBD	0.3	0.46	-1.17	3.88
EDu	Europe Dummy	WBD	0.15	0.36	0	1
FeR	Fertility Rate	WBD	3.01	1.61	0.9	7.75
G15	Growth Rate Population < 15	WBD	0.53	1.53	-4.24	5.33
G64	Growth Rate Population > 64	WBD	2.76	1.39	-4.89	7.78
GDp	Growth Rate Real GDP per capita	WBD	2.07	3.67	-29.64	20.5
GER	Growth Employment Rate	PWT	0.021	0.03	-0.16	0.29
GRA	Growth Rate Labor Force	WBD	1.77	1.23	-3.83	8.24
GRD	Growth Rate Dependent Population	WBD	1.08	1.18	-2.83	5.57
GRP	Growth Rate Population	WBD	1.47	1.02	-3.34	6.02
GSa	Goverment Savings Rate	FRS	-0.02	0.05	-0.32	0.4
LiE	Life Expectancy	WBD	4.23	0.16	3.58	4.43
NaD	North America Dummy	WBD	0.03	0.16	0	1
NRA	National Resources Abundance	WBD	0.14	0.1	0.01	0.98
Opn	Openness	WBD	0.77	0.58	0.14	4.55
QGI	Quality Goverment Institutions	WBD	0.6	0.18	0.08	0.93
RaG	Ratio GDP to U.S. GDP per capita	WBD	0.31	0.41	0.01	1.6
RCL	Ratio coastline to land area	WBD	0.31	0.9	0	7.4
SDu	South America Dummy	WBD	0.16	0.37	0	1
SDu	Tropics Dummy	WBD	0.49	0.5	0	1
USP	Urban Share Population	WBD	0.55	0.24	0.086	1
YSS	Years of secundary schooling	B-L (2012)	0.3913	0.7	0.01	4
T24	Growth Rate Employment 15-24	ILO	0.34	5.36	-24.38	24.97
F24	Growth Rate Female Employment 15-24	ILO	0.56	7.24	-60.35	43.36
M24	Growth Rate Male Employment 15-24	ILO	0.27	5.26	-27.21	26.43
T25	Growth Rate Employment > 25	ILO	2.31	2.04	-8.52	12.22
M25	Growth Rate Female Employment > 25	ILO	2.97	3.32	-17.26	28
F25	Growth Rate Male Employment > 25	ILO	1.96	1.9	-9.28	10.24
T15	Growth Rate Employment > 15	ILO	1.98	2.31	-8.93	12.2
F15	Growth Rate Female Employment > 15	ILO	2.52	3.58	-19.88	25.16
M15	Growth Rate of Male Employment > 15	ILO	1.68	2.15	-9.39	10.66

Source: Authors' Elaboration (2017).

5 ECONOMETRIC RESULTS

Now, we will show our findings:

5.1 A Global Approximation

We estimate the following model:

$$y_{it} = \alpha_{it} + \beta_{it}^T x_{it} + \mu_{it}$$
$$i = [1, ..., 74]', t = [1990, ..., 2014]'$$

where $y_{it} = [GDp_{it}]$ is a unidimensional vector of endogenous variables and $x_{it} = [GRP_{it}, GRA_{it}, DRG_{it}, T24_{it}, T25_{it}, F24_{it}, F25_{it}, M24_{it}, M25_{it}, T15_{it}, F15_{it}, DER_{it}, RaG_{it}, LiE_{it}, YSS_{it}, NRA_{it}, Opn_{it}, QGI_{it}, APD_{it}, GSa_{it}, TDu_{it}, RCL_{it}]'$ is a multidimensional vector of exogenous variables.

We tested different models: fixed effect, random effect and pooling effect and choosing the most appropriate through Hausman and Woldridge tests. In tables 3 and 4 will be possible observe the results of each one of the tests for each one of the regressions realized in the tables 5 and 6.

According with the statistical results the best model is random effect. However, we will consider the pooled for being consistent and relying on less restrictive hypotheses than the RE.

Tabela 3 – Tests of serial correlation of table 5

	1p	2p	3p
Hausman Test	0.99	1	0.99
Woldridge Test[a]	0.0077	0.0044	0.02
[a] : *For unobserved individual effects*			

Source: Authors' Calculations (2017).

Next, we will begin by examining population aging on economic growth and explaining from economic theory what this means (table 5). Then, we will measure the effect of growth in the employment on economic growth and the role of women within the workforce as a mitigation of the economic decline due to the aging of the population (table 6).

In table 5, column 1p, there are significance relationship between population (GRP) growth and growth of gross domestic product (GDP) per capita, nevertheless supporting the pessimist position. This is due to the rising shares of dependent cohorts both youth dependency

Tabela 4 – Tests of serial correlation of table 6

	1p	2p	3p	4p
Hausman Test	0.989	0.99	1	0.999
Woldridge Test[a]	0.017	0.01624	0.0146	0.02
[a] : *For unobserved individual effects*				

Source: Authors' Calculations (2017).

burdens and working-age adults, partially because of the aging of baby boomers and the slow decline in fertility rates in Latin America and part of Asia.

This effect seems plausible given the connection between productivity and the size of the current labor force relative to the total population showed by (FEYRER, 2007). For this reason, distinguishing these two components when exploring demographic change becomes valuable.

Column 2p of table 5 shows separately the effect - on the growth - of the economically active population (GRA) and the dependent population, in order to understand the natural transition that the baby boomers are undergoing to aging.

Growth in the economically active population is weak, positive and significant, while that of dependent population growth is strong, negative and significant. That is to say, an increase of 1 percent in the growth of the working-age population is associated with an increase of 0.96 percent in the growth rate of GDP per capita. In contrast, an increase of 1 percent in the growth rate of the overall population(the dependent population, because the growth rate of the working-age population remains fixed) is associated with a decrease of -1.76 percent in the growth rate of GDP per capita.

In demographic transitions, when the age distribution changes, population growth does matter. Because of this, table 5 column 3p shows what happens when the impact of the growth of the working-age population and the growth rate of the total population are restricted to be equal, but with opposite sign. There are two possible scenarios, when there are high growth rates of GDP per capita or when ocurrs the opposite, low growth rates. The latest represent our case. It shows that the dependent population is growing more faster than the work force. In fact, the coefficient is small, positive and significant.

The coefficients of the other variables are similar to the expected theoretically. For example, the openness (Opn) is characterized by an emphasis on transparency and free unrestricted access to knowledge and information. As long as this indicator is positive, the impact on the growth of the countries will be positive. Is large, positive and significant.

In the same sense, with education (YSS) and the quality of institutions (QGI) to mention only a few. However, it would be important to emphasize the impact in life expectancy (LiE). While its coefficient is negative and accented in the columns 1p and 2p in the 3p is positive and small. This is because the growth of the dependent population is higher in the last years than the non dependent, and that the majority of this population are young people with increasing life expectancies, approximately 88 percent on average. This has an impact on negative growth.

It is important to clarify that if measures are not apply to mitigate this natural transition, it may trigger a important economic decrease, requiring a greater effort to compensation for innovation and technology. Even in some countries, given their institutional and structural weakness, they have to go directly to the slowdown without having experienced the growth offered by the demographic bonus.

To mitigate this decline in the per capita growth indicator given by the aging of the baby boomers, one of the most exposed and discussed in current literature is to expand the retirement age see (BLOOM; CANNING; FINK, 2010) and generate greater opportunities in the labor market for women see (BLOOM et al., 2009). Working directly with characteristics of employment growth rather than pure population growth is useful to observe the impact of these variables on per capita GDP. In table 6 report only the coefficients on the employment variables. In column 1p, it can be observed that the effect of the growth rate in employment for the population under 25 years (T24) and over 25 years (T25) are small, positive and significant, after applying the demographic controls. That is, an increase of 1 percent in the growth rate in employment represents on average 0.15 percent in the growth rate of GDP per capita, much less than the growth explained by the demographic bonus. (BLOOM; CANNING; SEVILLA, 2001) and reiterated by (HEIJDRA; REIJNDERS, 2012), explaining that the rise of human capital investment and institutional strength are necessary when the population Ages fast. Although employment growth rates were more marked than those of population growth, there is a marked gap between the progress of institutions, investment in human capital and supply of employment.

In column "2p", we disaggregate the effect of women and men employed. It can be observed that women between 15 and 24 years old (F24) have a small, positive and statistically insignificant coefficient. However, women older than 24 years (F25) have a negative, small and statistically significant coefficient. We conjecture that this is because although the growth rate of employment of women has rise more rapidly than that of men in recent years, yet the number of women in the market does not, in relation to that of men. This means that the proportion of women in the labor market has not changed marginally in the last 20 years. In figure 2 it can be seen that the female employment-population relationship with identical characteristics to men experiment a slightly grow for almost 15 years than that of their opposite, including experimented higher rates of population growth and lower levels of participation in the market. This is due in large part to the fact that important advances have been made in the area of labor equality, but not sufficient to mitigate the transition from the current aging, as shown in the tables. In contrast, the two coefficients representing the impact in the growth rate of GDP per capita of men employed (M24 and M25) are large, positive, and significant. Where the greatest growth is observed in men over 25 years.

Tabela 5 – The Effect of Growth in the Population and the Economically Active Population on Economic Growth

	1p	$2p^a$	3p
(Intercept)	2.79	11.58	−7.83
	(6.19)	(6.60)	(6.01)
	(0.68)	(0.67)	(0.68)
GRP	-0.75^{***}	-1.77^{***}	
	(0.13)	(0.31)	
GRA		0.97^{***}	
		(0.26)	
DGR			0.54^{*}
			(0.25)
RaG	-1.27^{***}	-1.07^{***}	-1.20^{***}
	(0.14)	(0.15)	(0.15)
LiE	−1.08	-3.19^{*}	0.88
	(1.36)	(1.47)	(1.36)
YSS	0.26^{**}	0.27^{***}	0.28^{***}
	(0.08)	(0.08)	(0.08)
NRA	-4.15^{***}	-4.23^{***}	-2.98^{**}
	(1.08)	(1.07)	(1.07)
Opn	1.66^{***}	1.69^{***}	1.23^{***}
	(0.25)	(0.25)	(0.24)
QGI	5.59^{***}	6.01^{***}	7.22^{***}
	(0.96)	(0.96)	(0.95)
APD	−0.33	−0.32	−0.16
	(0.33)	(0.32)	(0.33)
GSa	17.51^{***}	17.02^{***}	15.05^{***}
	(2.10)	(2.10)	(2.10)
TDu	-0.80^{***}	-0.88^{***}	-0.89^{***}
	(0.24)	(0.24)	(0.24)
RCL	−0.20	−0.20	−0.05
	(0.13)	(0.13)	(0.13)
R^2	0.28	0.29	0.27
Adj. R^2	0.27	0.28	0.26
Num. obs.	1201	1201	1202
$^aF - satat$: p-value: < 2.22e-16***			

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

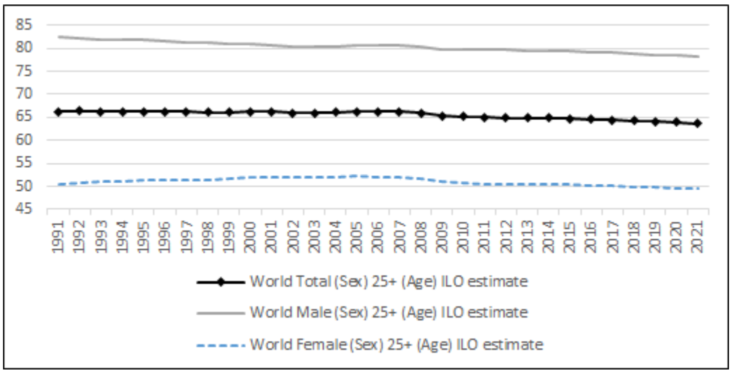
Note: The dependent variable is the growth rate of real GDP per capita in purchasing power parity terms. Estimates are from ordinary least squares. Standard errors are reported in parentheses.

F-stat: Test of the null hypothesis that the population growth rate equals the negative of the growth rate of the economically active population.

Source: Authors' Calculations (2017).

In the runs made in the following columns, we are based on the same empirical principle

Figura 1 – Employment to population ratio by sex and age 25+.



Source: Autor's Calculation (2017).

of table 5. In table 6, columns "3p"and "4p"are in line with what is observed in column "2p". In the first, the coefficient of the growth rate of employment of women older than 15 years (F15) is negative, small and significant, and the remainder (effectively, the men, since the empirical specification holds the growth rate of employment of men older than 15 years (T15)) is positive, large and statistically significant. In steady state, when the distributions of workers are stable, the growth of workers in either of these two specifications (male and female). It should be noted that the traditional model of Solow-Swan absorbs this factor within the coefficient of growth of the workers. Therefore, these effects within our model are disaggregated so as not to cause any deviation in magnitude. In transition, disaggregations of these specifications matter, given the aging of baby boomers. The coefficient is small, negative and significant. Therefore, for our example, where the employment growth rate in women exceeds the employment growth rate in men, negative growth rates in GDP per capita appear (ceteris paribus). As we have seen in the graphs, the growth rates in female employment grow faster than their share in the labor market, together with the fact that they have a higher life expectancy and are larger in number, the effect of which is the associated economic decline to 11 percent in average. Likewise, this is a reflection of the weakening of institutions and disinvestment in human capital, key factors for the development of the countries.

Tabela 6 – The Effect of Growth in the employment rate on Economic Growth

	1p	2p	3p[a]	4p
(Intercept)	-14.53^{**}	-16.65^{**}	-16.69^{**}	-8.65
	(5.61)	(5.59)	(5.59)	(5.65)
T24	0.11^{***}			
	(0.02)			
T25	0.18^{**}			
	(0.06)			
F24		0.02		
		(0.02)		
F25		-0.08^{*}		
		(0.04)		
M24		0.07^{**}		
		(0.03)		
M25		0.38^{***}		
		(0.07)		
T15			0.68^{***}	
			(0.08)	
F15			-0.24^{***}	
			(0.05)	
DER				-0.09^{*}
				(0.05)
R^2	0.31	0.32	0.32	0.22
Adj. R^2	0.30	0.31	0.31	0.21
Num. obs.	1141	1141	1141	1245
$^{a}F - satat$: p-value: < 2.22e-16***				

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Note: The dependent variable is the growth rate of real GDP per capita in purchasing power parity terms. Estimates are from ordinary least squares. Standard errors are reported in parentheses.
F-stat: Test of the null hypothesis that the population growth rate equals the negative of the growth rate of the economically active population.

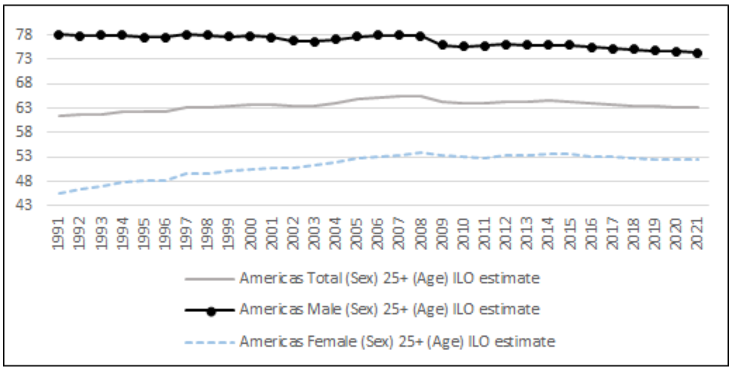
Source: Authors' Calculations (2017).

5.2 Latin America

In the current scenario, Latin America remains and will remain a young continent, but not for long. It is almost a global trend that birth and death rates continue to fall, in each of the modern democratic societies, and that in turn, these factors are essential to the demographic bonus. But, unlike the European, Asian and northern continents, it is not guaranteed that it can happen in Latin America. In many countries of our continent their institutions are still weak and unstable. Important part that guarantees the demographic bonus is that the necessary mediations come from them and prevail, otherwise this bonus will go unnoticed.

In Latin America, the negative impact of the elderly boomers on economic growth is less, since young populations are still being able to replace them in some proportion, but will not be sustainable in the medium term. It is estimated that birth rates in the continent continue to fall with a not so steep slope and not so accelerated until the year 2050. This can also be explained because Latin America represents better indicators in the employment-population relation with respect to the rest of the sample. Figure 2 shows a more pronounced growth in this ratio, under similar conditions of population growth rate and levels of participation than the rest of the world. This allows to partially mitigate the effect with the pregnant labor force. The following two tables present the results obtained by our study.

Figura 2 – Employment to population ratio by sex and age 25+.



Source: Autor's Calculation (2017).

In Table 7 it can be seen that labor force growth (GRA) is large, significant and positive, much more than observed when taking countries, which was expected. That is, an increase of 1 percent in the growth rate in employment represents 1.90 percent in the growth rate of GDP per capita. This explains why, despite declining birth rates and the growing boomer life expectancy, Latin America is achieving a relatively acceptable demographic replacement rate in the short term.

Therefore, in table 8 column 4p, where the employment growth rate in women exceeds the employment growthrate in men, positive growth rates in GDP per capita appear (ceteris paribus). The growth rates in female employment grow in equal proportion that their share in the labor market, together with the fact that they have a higher life expectancy and are larger in number, the effect of which is the associated economic increase to 18 percent.

Nevertheless, a combination of strong governance and openness to trade is necessary for the potential demographic growth might has a space in Latin America. This interaction is important.

So while the demographic transition produces favorable conditions, it does not guarantee that an increased supply of workers will be gainfully employed. Nor does it ensure that those who wish to save will find themselves encouraged to do so. Neither can it provide institutions to press home health advantages or to create the educated population vital to a high-value society.

Many Latin America's governments were corrupt, and repeated financial disasters had the effect of making saving ill-advised.

Tabela 7 – The Effect of Growth in the Population and the Economically Active Population on Economic Growth

	1p	2p^a	3p
(Intercept)	43.36^*	46.76^*	48.68^*
	(21.36)	(21.11)	(20.52)
GRP	-0.15	-2.05^{**}	
	(0.38)	(0.74)	
GRA		1.90^{**}	
		(0.63)	
DGR			1.90^{**}
			(0.63)
RaG	0.64	0.62	0.68
	(0.48)	(0.48)	(0.45)
LiE	-9.88^*	-10.94^*	-11.44^*
	(4.76)	(4.72)	(4.54)
YSS	-0.18	-0.03	-0.06
	(0.21)	(0.22)	(0.20)
NRA	-1.43	0.62	0.64
	(2.47)	(2.53)	(2.53)
Opn	0.24	0.42	0.46
	(1.03)	(1.02)	(1.01)
QGI	5.43^*	5.89^*	5.98^*
	(2.53)	(2.50)	(2.49)
APD	-1.86^*	-1.99^*	-2.09^{**}
	(0.85)	(0.84)	(0.80)
GSa	35.55^{***}	34.79^{***}	34.44^{***}
	(6.74)	(6.66)	(6.59)
TDu	0.30	-0.46	-0.52
	(0.63)	(0.67)	(0.65)
RCL	-0.59	-0.99	-0.99
	(0.64)	(0.64)	(0.64)
R^2	0.38	0.40	0.40
Adj. R^2	0.31	0.33	0.33
Num. obs.	332	332	332

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Note: The dependent variable is the growth rate of real GDP per capita in purchasing power parity terms. Estimates are from ordinary least squares. Standard errors are reported in parentheses.

F-stat: Test of the null hypothesis that the population growth rate equals the negative of the growth rate of the economically active population.

Source: Authors' Calculations (2017).

Tabela 8 – The Effect of Growth in the employment rate on Economic Growth

	1p	2p	3p[a]	4p
(Intercept)	45.30^{*}	42.20^{*}	46.81^{*}	26.45
	(20.30)	(20.44)	(20.33)	(20.13)
T24	0.15^{**}			
	(0.05)			
T25	0.15			
	(0.13)			
F24		0.11^{*}		
		(0.04)		
F25		-0.07		
		(0.08)		
M24		0.03		
		(0.06)		
M25		0.30^{*}		
		(0.13)		
T15			0.62^{***}	
			(0.19)	
F15			-0.15	
			(0.11)	
DER				0.18^{*}
				(0.09)
R^2	0.31	0.32	0.32	0.22
Adj. R^2	0.30	0.31	0.31	0.21
Num. obs.	1141	1141	1141	1245
$^{a}F - satat$: p-value: < 2.22e-16***				

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Note: The dependent variable is the growth rate of real GDP per capita in purchasing power parity terms. Estimates are from ordinary least squares. Standard errors are reported in parentheses.
F-stat: Test of the null hypothesis that the population growth rate equals the negative of the growth rate of the economically active population.

Source: Authors' Calculations (2017).

6 CONCLUDING REMARKS

The most important findings of this work are:

a) There was a decrease in productivity of the overall population (GRP), about 72 % in average. That is, an increase of 1 percent in the growth rate of the overall population is associated with a decrease of 1.77 percent in the growth rate of GDP per capita.

b) There was a decrease in productivity of the active population (GRA), about 34 % in average. That is, an increase of 1 percent in the growth rate of the working-age population (effectively, the no dependent population, since the empirical specification holds fixed the growth rate of the dependent population) is associated with a slight increase of 0.97 percent in the growth rate of GDP per capita. Less than 1.

c) The the dependent population is growing more rapidly than the work force, the estimates provide evidence of slower growth. That is, an increase of 1 percent in the (DGR - Difference Growth Rate) is associated with a slightly increase of 0.54 percent in the growth rate of GDP per capita.

d) The growth rates in female employment grow faster than their share in the labor market, together with the fact that they have a higher life expectancy and are larger in number, the effect of which is the associated economic decline to 11 percent in average.

e) So while the demographic transition in Latin American produces favorable conditions, it does not guarantee that an increased supply of workers will be gainfully employed. Nor does it ensure that those who wish to save will find themselves encouraged to do so. Neither can it provide institutions to press home health advantages or to create the educated population vital to a high-value society. Many Latin America's governments were corrupt, and repeated financial disasters had the effect of making saving ill-advised.

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